

**Terminal Report of the Independent
Baseline Assessment of the FISH Project
Sites:
with Process Documentation**

Contract: LAG-I-10-99-00017-00

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I. Introduction

The Philippines is the hottest of the hotspots in the highest marine biodiversity areas of the world (Roberts 2001, Aliño et al. 2004a and b). Despite its great marine resources and biodiversity potentials the grave threats of environmental degradation and overexploitation of resources in its coastal ecosystems have been linked to poverty and rapid population growth. These concerns are important since further fisheries decline will not only lead to the lowered resilience of these ecosystems to provide environmental goods and services but threatens to cascade to other societal consequences exacerbating food and social security (Israel 2004 and DA-BFAR 2004). These have been the driving impetus to meet the challenges of marine biodiversity conservation and sustainable fisheries productivity in the Philippines. In its wisdom the United States Agency for International Development (USAID) initiated the Fisheries Improved for Sustainable Harvest (FISH) Project. FISH also continues and complements the consistent efforts of USAID in resources management and governance in the Coastal and Marine sector in collaboration with other agencies in the country. An inherent part of the FISH Project is the fisheries ecosystem-based management approach that takes in consideration the concerns of the natural ecosystem and its users. FISH seeks to: 1) Strengthen the capability of local and national institutions to manage coastal resources and marine fish stocks; 2) Improve national and local policies for more sustainable use of coastal resources and marine fish stocks; and 3) Build national and local support for more responsible management of coastal resources and marine fish stocks.

Four target sites have been chosen for the project, including the Calamianes Islands in Palawan, Danajon Reef in Bohol, and Tawi-Tawi and Surigao del Sur in Mindanao. The FISH Project will support the efforts of the Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) and local government units (LGU).

The contract for engaging a Third Party Independent Baseline contractor (referred to here as the baseline contractor) is to support the establishment of baseline information for the FISH Project. This independent baseline assessment is undertaken through the USAID contract LAG-1-00-99-00017-00. Its main purpose is to validate the baseline coastal and marine capture fisheries resources in the four FISH project sites and to identify and recommend indicators and expected targets for each site, and measure project progress in increasing fish stocks by at least 10% over the next seven years.

1.1 The following evaluation questions are to be addressed by the baseline contractor (see Appendix D-i):

- 1.1.1 What are the indicators at each site and expected targets for years 6 and 7? What is the status of the coastal and marine capture fisheries resources in all four sites from the 2003 baseline study?
- 1.1.2 What are internationally recognized best practices in establishing baseline information for coastal and marine capture fisheries resources management? Of the identified best practices, what are the tried and tested innovative approaches, tools, and techniques for conducting participatory baseline studies that are replicable and applicable for USAID and the Philippines context?
- 1.1.3 What would be an appropriate and efficient methodology for an independent assessment of the baseline study to be conducted by the FISH contractor? What field-based processes and tools, such as sampling procedures, participatory data gathering techniques, etc, are applicable for each site in the conduct of an independent assessment of the baseline?
- 1.1.4 What is the best approach for reconciling or integrating the results from the baseline contractor and that of the FISH contractor's baseline study?

In order to address these questions and fulfill the deliverables of the baseline contract we provide the details of the process documentation as integrated into this terminal report. The different sections address specific aspects of the above-mentioned questions. Where pertinent, evaluation results are integrated and synthesized with lessons and insights from the other sections.

Section 2 details the major processes, the conceptual framework and objectives of each activity, the tasks and their expected deliverables, and adjustments made to overcome constraints. The concerns of questions 1.1.1-1.1.2 are primarily addressed in *Section 2*.

Sections 3 and 4 primarily address the questions 1.1.3 and the 1.1.4. *Section 3* presents the major results of the site assessment reports and also links the concerns of Sec. 1.1. (i.e., on the status of the fisheries resources based on the baseline study) with the two other questions (Sec. 1.1.3 and 1.1.4). A summary of the approaches for reconciling and integrating the results of the baseline and FISH contractor is also presented in *Sec.3*.

Section 4 summarizes the substantive considerations discussed during the integration workshop and the proposed baseline indicators.

Section 5 provides the analyses and recommendations on the Performance Monitoring Plan (PMP) of the FISH contractor and their Performance Fee Payment Plan (PFPP). Logically, Sec. 5 also gleans from the previous sections, integrating the actual field experiences and state indicators discussed in Sec. 3 and discuss the implications of the results presented in the previous sections on the PFPP.

Section 6 provides the overall summary and recommendations with emphasis on the major insights derived from each process and activity. Adaptive management approaches and lessons learned from the activities, gaps, opportunities and the challenges that could be addressed in the next coming years of the FISH project life.

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Scope of Work and Activities

The conceptual approach and praxis of fisheries ecosystem-based management together with performance-based monitoring, is considered an important innovation and emergent good practice in coastal resource management and governance (see DAI Baseline Assessment Review). Independent baseline assessments are crucial to make this practice a reality, especially if this is linked to an incentive system (i.e., Performance Monitoring Plan and Performance Fee Payment Plan). Harmonizing the administrative considerations and operational concerns with the actual interventions on the holistic context of society and its natural ecosystem is truly a challenge. We present the Scope of Work and its deliverables based on Tables 2.1 and 2.2 and the lessons learned we have derived and share our insights and suggestions to contribute to improving and sustaining fisheries harvests.

Deliverables, Schedules and Adjustments

We present here some insights on the baseline assessment process from the scope of work and mobilization, review of good practices in baseline assessments, FISH-Baseline workshops, entry and preparatory activities in field assessments, feedback from field assessments, integration workshops, initial discussions on PMP and PFPP and process documentation and popularization feedbacks.

Table 2.1a. Matrix of activities and deliverables and adjustments made

MONTH	PLANNED	ACTUAL
October 2003	<ul style="list-style-type: none"> • Scoping on best practices • Approved Independent Baseline study design and methods • Assess report on FISH Proposed Baseline Study Approach and Method 	<ul style="list-style-type: none"> • Mobilization of Project Team
November 2003		<ul style="list-style-type: none"> • Baseline review • Revised SOW and Workplan • Review of Good Practices • 1st Baseline study workshop
December 2003		<ul style="list-style-type: none"> • Documentation of FISH Baseline Study Workshop Proceedings • Initial remote sensed satellite data rectification and enhancement with GIS reference and mapping • Logistic prep for the 1st site assessment: Bohol (Jan, 2004)

Mobilization and scope of baseline assessment

The design of the Baseline Contractor's Baseline Study was approved in October 2003. The baseline assessment team was mobilized immediately in order to undertake the first field assessment trip by November 2003. This was proposed in order to have the baseline assessment of all the four targeted sites during the northeast monsoon. It was expected that the baseline study would be undertaken in six months. The assessment was to be done in parallel with the FISH contractor. However mobilization of subcontractors for the FISH baseline assessment was delayed due to the unavailability of expertise from their potential subcontractors, considering other prior commitments (e.g., teaching and other projects). In addition, other requirements pursuant to USAID contracting procedures had to be addressed before the subcontractors could be fully mobilized.

Suggestions and Adjustments

In future, USAID may consider entry of the Independent Baseline Assessment contractor immediately after the first quarter mobilization.

Alternatively, since it is important that the baseline contractor understand the design process and other preparatory initiatives of the project contractor, then earlier engagement is important. In this regard if the baseline contractor is engaged on the second month of the project, as is the case in this project (i.e., for this case a nine-month contract), a longer contracting period should be considered.

Baseline assessment review and 1st workshop

Discussions with the FISH contractor have been candid but constructive such that these facilitated the necessary adjustments, to the benefit of the whole baseline assessment process. The first baseline assessment workshop with the FISH contractor was very useful in this regard. A review of the baseline assessment good practices submitted by the baseline contractor (Appendix C-1), was also crucial as a discussion document with the FISH contractor. This highlighted the need for a fishery-independent Project Results (PR) indicator and size observations for biomass estimates based on fish visual census when monitoring MPAs. Seagrass and mangrove habitat assessment and monitoring methods were included in the baseline assessment review. Notably these were not discussed in the FISH contractor's baseline study approach. In addition, the entire baseline assessment was benefited from the use of remote sensing in habitat mapping and site-specific oceanographic conditions that are necessary for an ecosystem-based approach to fisheries management.

Avoidance of confusion by the beneficiaries was a paramount consideration in the baseline assessment. To address this, arrangements were made between the FISH and baseline contractors on the community entry procedures and the orientation process for the target beneficiaries and partners.

The baseline contractor made a revised scope of work reflecting adjustments in the schedule to accommodate the changes in sampling schedules and the feasibility of sampling the focal areas during the NE monsoon period (January to February 2003) and the inter-monsoons (March to May 2004). This has implications on the timing and comparability of subsequent independent project performance monitoring activities.

Suggestions and recommendations

Considerations on expertise availability and weather conditions that will affect the spatio-temporal variability of the baseline assessment results and subsequent monitoring are necessary. Likewise design considerations of fishery-independent approaches are necessary to understand the management scales, the effects of natural variability changes vis-à-vis human-induced variation (e.g., project intervention and threats). It is important that the design of fishery-independent baseline assessment indicator should consider these potential sources of variability and their interactions. Consideration of these interactions (e.g., ecological structure and function relationship, and the ecosystem responses to the changes in threats and management interventions are important) will be crucial. An ecosystem based management framework would be useful (e.g. FISH BE or EcoSim) to incorporate these attributes to help design the baseline assessment and subsequent monitoring.

Characterization of other habitat and ecosystem attributes (e.g., mangroves and seagrass and the prevailing oceanographic conditions) should be considered as appropriate to the conditions in the area, with its significance to fisheries management.

Table 2.1b. (cont'd.). Matrix of activities and deliverables and adjustments made

MONTH	PLANNED	ACTUAL
January 2004		<ul style="list-style-type: none"> • 1st site assessment: Danajon Bank, Talibon, Bohol
February 2004	<ul style="list-style-type: none"> • Proceedings of Workshop that integrates or reconciles the Baseline studies of FISH and Baseline contractors (Moved to July 2004) • Report on the Results/Findings of the Independent Baseline study (Moved to June 2004) 	<ul style="list-style-type: none"> • 2nd site assessment: Bongao, Tawi-tawi
March 2004	<ul style="list-style-type: none"> • Assessment report on the FISH Contractor's proposed Performance Management Plan (PMP) and Performance Fee Payment Plan (PFPP) (moved to August 2004) • Process documentation report of the Independent Baseline study Assessment process (moved to August 2004) 	<ul style="list-style-type: none"> • 3rd site assessment visit: Cortes, Surigao del Sur • Approval of the no-cost extension of the DAI Contract with USAID to May 31, 2004

Pre-Field assessment preparations

Preparations for the field assessments followed community entry protocols agreed upon by the FISH and the baseline contractors. This required prior rapid appraisal by the field assessment site coordinators of the FISH Project. This process was also facilitated by an initial feedback and design workshop of all FISH project partners on February 4-6, 2004 at Tagaytay City. At least one month of preparatory activities (e.g., establishing contact people, venue, consultations and scheduling of assessments) were necessary before entry and orientation of various stakeholder partners in the focal site. Two weeks prior to full team entry, all logistic preparations had been established by the baseline assessment contractor, in coordination with the FISH contractor (e.g., FGD interviews schedules and key informants, enumerators partners, board lodging and transportation and feedback, etc.). Feedback presentations for each focal site are attached in Appendices B-2 to B-5.

Suggestions and recommendations

Initial site appraisals were crucial in determining constraints and operational needs for site assessments. Preliminary discussions with FISH implementers, on-site partners and

other partners (e.g., DA-BFAR and USAID) are important to level off expectations on the objectives, scope (phase of the project) and expected outcomes from the FISH Project. Feedback sessions sharing the initial impressions derived from the baseline activities were met with warm response. Many of the sites welcomed the participatory opportunities from interaction with local enumerators, and learning from the initial results on-site.

It is suggested that these procedures (i.e., preparatory activities, entry and orientation protocols, and exit feedback process) become an important good practice procedure submitted in at least a one-page activity brief with clear roles and responsibilities outlined.

Review of Baseline Assessment Methodology of FISH

A formal document on the FISH Baseline Assessment Plan (BAP) became available in April 2004. A more detailed discussion is presented in Appendix C-3 on the evaluation made by the baseline contractor a month after receipt of the copy of the Baseline Assessment Plan (FISH Document 06-FISH/2004). Feedback on this evaluation was provided during the integration workshop on July 26-27, 2004 (see Appendix B-7A, and summarized in the matrix Table 2.2). The substantive concerns on the BAP are mainly in relation to five main points: i) Need to enhance the integrative framework analyses to help improve design in linking interventions and ecosystem responses in order to provide scale and context of indicators (primary vis-à-vis other indicators; see also Sec. 5 linkage to PMP & PFPP); ii) Need to consider other criteria in choosing subsequent focal sites vis-à-vis its significance to the goal of the target ecosystem management unit; iii) Need to decide on the Project Result (PR) indicators and how these are related to the Performance Monitoring Plan and Performance Fee Payment Plan ; iv) Need to reconcile the results of the FISH baseline assessment plan with the independent baseline assessment; and v) Need to differentiate the PFPP with the criteria for deciding on the extension for year 6 and 7.

Table 2.1c. (cont'd.). Matrix of activities and deliverables and adjustments made

MONTH	PLANNED	ACTUAL
April 2004		<ul style="list-style-type: none"> • 4th site assessment
May 2004	<ul style="list-style-type: none"> • Initial review of Baseline assessment of FISH Contractor (1st week) 	<ul style="list-style-type: none"> • Submission to USAID of report on the Review of the FISH Project Baseline Assessment Plan • Approval of no-cost extension of the DAI contract with USAID to August 31, 2004
June 2004	<ul style="list-style-type: none"> • PMP-Initial feedback on preliminary draft of FISH contractor (1st week) • Initial site report process documentation (4th week) 	

July 2004	<ul style="list-style-type: none"> • Integration workshop of FISH contractor and Independent Baseline assessment contractor 	
August 2004	<ul style="list-style-type: none"> • PFPP – Draft Final Review report (2nd week) • Performance Monitoring report (3rd week) • Final draft report of process documentation (4th week) 	

Also, relevant to this discussion are the evaluation report of Dr. Barbara Best (Appendix C-4) and the FISH project response to the baseline contractor and the proceedings of the integration workshop [See also summary of Sec. 3 Site Assessment reports of this report for specific highlights of indicators].

In summary, the following are the suggestions in the evaluation made by the baseline contractor. Basically, this has been presented to Dr. Best and also during the integration workshop to the FISH contractor team, and updated based on their feedback.

1. On the conceptual framework, though the FISH project's conceptual framework is in general sound, it can be further improved. Opportunities to use some ecosystem-based models (e.g. FISH BE – Licuanan et al. 2004, in press and Walters et al. 1999) will help guide the design and refine the sampling methods of FISH. This is especially important in putting into context the scale concerns (i.e., spatially, temporally and ecologically) of the intervention areas. At present, there is some consensus on the scale of intervention in a focus site e.g., in MPAs it should cover at least 10% of the coral reef area estimate. For example, 70 hectares of a 700-hectare reef area for MPAs (based on satellite image analyses) will be assessed for Talibon, Bohol. How these indicators are translated or extrapolated for understanding the degree of interventions and their likely impacts on the focal area are equivocal. Some explorations on the interactions of the measured parameters will help refine hypothesis, decisions and interventions. Though the degree of the impact may not be absolutely determined, the degree to which these impacts can be surmised in broad strokes, for design purposes and for leveling off expectations to the relevant stakeholders, would be important. This can be done sometime in the near future (e.g., around October) when sufficient information is derived or by using initial

exploratory data to assist in helping FISH clarify priority interventions and their possible interactions (e.g., MPA sizes, fishing effort regulations and regulating entry into municipal waters).

2. Though it can be understandable that the initial choice of focal areas within the target areas may often be based on operational feasibility of the sites as an initial entry, it might be crucial to gauge the strategic importance of the ecological value of the area to the overall outcomes of the project in the target area (e.g., strategic control of commercial fishing activities in fishing effort in specific areas). In the Calamianes area, the other western municipalities (e.g., Binudac) are crucial in having a large effect on the fisheries yield in the Municipality of Culion.
3. The primary indicator of performance should be based on a fishery independent indicator. Project result indicators PR 1 (especially for soft bottom and pelagic habitats) and PR3 (for coral reefs) satisfy this criterion. But since the scale-dependence of these ecosystem components is determined by the detection levels of these areas, a particular dominant gear used in the area could be used to represent the areas' response to the project interventions (e.g., enhancement and effort control of the crab fishery and sea ranching of groupers and *de facto* MPAs derived from the pearl farm concession areas). Since the area being monitored for an MPA can vary, a minimum area of 10% coral reef MPA to be fully protected (no-take areas) is necessary; to have a minimum aggregated effect that may represent a contribution to the 10% increase in fisheries stocks. In addition, the other indicators can be used as "reference", enabling ("process") or intermediate results to be used to support or understand the context of the performance effectiveness of the management interventions (e.g., size class changes in conjunction with the CPUE indications of PR2 and fish census size estimates for PR3 to understand and gauge the change in proportion of biomass change within and outside the no-take area).
4. Since full validation of the baseline assessment by the FISH contractor has not been completely reconciled with the baseline assessment in the context of parallel

assessments, the complementation of the results can only be partially assessed based on the initial results and the methods used. Initially, these seem to be comparable and may afford some joint analyses (e.g., pooling and comparison for subsequent meta-analyses (Cote et al. 2001). It is suggested that subsequent monitoring by the FISH baseline assessments (e.g., 2006) be made in parallel to the independent baseline assessment team. Gauging the changes relative to baseline assessments whether pooled or not can be further explored in the interim years. This is a crucial consideration to minimize observer bias and variability. In addition, the innovative and the challenging motivational feature for the FISH Project is the independent nature of the baseline assessment team. This is likewise linked to the PFPP and is an important feature of good coastal governance, and environmental and resources management, in general. This leads us to its significance of the baseline assessment of the PMP and PFPP.

5. As discussed also in Sec.5, the PMP results (e.g., quantitative results in PR 1 and PR3) cannot be averaged but should be taken into context relative to the other indicators. Each of these results should be taken separately for each site. Achieving the 10% increase in the PR1 for each site would then suggest that the bonus performance fee would be given based on each site performance. The 10% achievement does not anyway prejudice the payment of the project. Together with the other reference, enabling/process and intermediate results indicators, this will be one of the basis for project extension to Years 6 (2009) and 7 (2010).

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Table 2.2. Summary FISH Baseline Assessment Plan (BAP) attributes and Baseline Contractor remarks and suggestions (see also Sec.3, 4 and 5 Discussions).

Activity and Deliverables	FISH documents and activities	Baseline contractor's evaluation remarks/suggestions/ recommendations
1. Conceptual framework and approach	Conceptual Project Framework of FISH (see 1 st DAI - FISH workshop proceedings and Tagaytay documents) and Review of Baseline Assessment Methods and Good Practices (DAI document)	1. General agreement on most of the methodologies was made. Ttech - FISH agreed on the merit of fisheries-independent assessment techniques and incorporate these in their Project Results (PR) indicators. Consider using integrative ecosystem based models in enhancing baseline assessment design.
2. Baseline Assessment Report Review	2. Baseline Assessment Plan (FISH Document 06-FISH/2004)	2. Refer to other DAI Baseline Report review June 2004, Appendix C-3
2.1 Local Implementation Areas	2.1. Scoring -- Weighting of criteria should be considered vis-à-vis other criteria (e.g., no. of fishers in the focal areas, diversity and extent of habitat)	2.1 In general, the process of the selection of sites needs to be refined so as to be able to have adaptive elements as new information become available.
2.2 Performance Indicators and monitoring	2.2 Clarify objectives of baseline as linked to interventions, the ecosystem's response as they relate to monitoring (Table 6 of FISH document 06-/2004)	2.2 Comparability among indicators needs refinement; scales are ambiguous and technical basis for integrative approach using averaging of PRs is insufficient, Improve analytical and design approach.
2.2.1. PR 1 (CPUE) fishery independent	2.2.1 Discuss gears standardization	2.2.1 Consider grants for students
2.2.2. PR 2 (CPUE) fishery dependent	2.2.2 Discuss countervailing effects in the section	2.2.2 Consider effects of shifts in gears and efficiency
2.2.3. PR3 Fish abundance in/out MPAs	2.2.3 Discuss biomass and size distribution	2.2.3. Incorporate size class observations
2.2.4. PR 5 Change in species richness	2.2.4 Discuss changes in species not only species per se	2.2.4. Use of multivariate analyses together with meta-analyses for changes in composition (e.g., trophic groups)
2.2.5. PR 4 Benthic condition (live coral cover changes)	2.2.5. Discuss other indices for condition classes	2.2.5. Incorporate fixed transects

Table 2.2b. Summary FISH Baseline Assessment Plan (BAP) attributes and Baseline Contractor remarks and suggestions (see also Sec.3, 4 and 5 Discussions).

2.3 Relationship among project result, performance indicators and intermediate indicators	2.3 Figure 7 can be improved to consider countervailing effects of different parameters and variables (e.g., increase in CPUE vis-à-vis fish abundance)	2.3 Relationship among project result, performance indicators and intermediate indicators (see also Section 4 of report)
2.4 Baseline Assessment Methods	2.4 Methods of assessment should be matched with analyses and design considerations	2.4 In general, all the methods used are sound but experimental design analyses need to be improved.
2.5 Integration, Diagnostic and Future Decision Support	2.5 Activities and schedules (Sec. 4 - 6) should be matched within the project intervention hypothesis, results, performance monitoring, adjustment response and feedback cycle process	2.5 Though the elements are present as stated in the schedule of activities, this can be enriched within the adaptive management cycle, by adjusting scales and interventions with project and partner collaboration effort.
3. Proceedings of the workshop	3. Facilitated understanding of perspectives on the PRs and some consensus on others	3. See Appendix D-1 for Proceedings of the workshop and this led to the DAI-Baseline Assessment Review
4. Assessment on the FISH's Performance Monitoring Plan and Performance Fee Payment Plan (PFPP)	4. Need to overcome constraints in the baseline assessment in the midyear monitoring. Based on PMP, the PFPP should be evaluated on a per site basis and not averaged.	4. See Section 4 for more detailed discussion on PMP and PFPP; PR1 is the main indicator for 10% while others are reference, enabling or process indicators; PR 3 should have a minimum area of 10% coral reef area being detected
5. Site Documentation Report	5. FISH contractor presented a preliminary site report on 29 July 04	5. Parallel assessment should be done together in mid-Project 2006 to afford better comparison, complementation and validation.
6. Integration workshop of FISH Contractor and Independent Baseline Assessment	6. Reached consensus on substantive concerns with PRs and other improvements, separate reports are to be submitted on PMP revision suggestions.	6. Please see Appendix D-2 for minutes. Improvements can be made if parallel assessments were completed to afford joint analyses.
7. PMP and PFPP	7. Only an initial was submitted.	7. Please see Section 4 for detailed discussion of PMP and PFPP
8. Final Process Documentation Report	8. Adjustments in schedules should take into account constraints with the FISH and Baseline contractors	8. This is the section that deals mainly on the lessons learned and the recommendations. Please see also summary and recommendations section.

Baseline Assessment Review and Benchmarking of FISH project sites

3.1 Synopsis of Review of Baseline Assessment – Good Practices

The earlier sections provided the context of the FISH and baseline contractors commitments to USAID and the target beneficiaries and partners. A review of the baseline assessment of good practices was submitted (see appendix C-1, 14 November 2003). The baseline contractor presented the globally accepted approaches and techniques on baseline assessment and their significance to the overall fisheries ecosystem management based approach. A recap of the review is summarized below.

As indicated in the Baseline Review, fisheries ecosystem management can be pursued in the context of adaptive co-management. It would entail three major phases of science inputs into the management strategy evaluation from the initial phase of baseline assessment indicators, to the design of monitoring and evaluation of performance measures and then linking these to the effectiveness of management in relation to its goals, objectives and targets.

The various criteria in the review of the FISH contractor relate to the various aspects of the framework of the PROJECT as information is utilized at various phases of a management strategy. Aspects of the criteria would relate to the evaluation of:

- a) The framework (e.g. through the management process of participatory planning and decision making, implementation and monitoring) and its approaches (e.g. science based [e.g. fishery independent techniques] and local knowledge and participatory features [e.g. Focus Group Discussions and Interviews]);
- b) The assessment and M&E methods together with their associated indicators and performance measures;
- c) The evaluation of the types of information gathered to achieve the management goals and objectives and their analytical procedures;

- d) The appropriate scale of the phenomenon that is being measured (e.g. target species or ecosystem functions or trophic groups);
- e) The adaptive features (hypotheses and adjustments to alternative scenarios), its mainstreaming and institutionalization of sustainable development systems.

The third party independent baseline and performance evaluation is a good practice that helps improve the elucidation of management effectiveness (e.g. Done and Reichert 2000 and WCPA 2002 on the biophysical, socio-economic and governance) and sustainability (sensu Charles 1994 referring to ecological, socio-economic and community) criteria for the performance of the FISH project. Since one of the major goals of the FISH project is to increase by 10% the fisheries productivity in the four target sites, much of the crucial evaluation hinges on the biophysical attributes. On the other hand it goes without saying that it is as crucial not to unduly neglect (as often is the gap) and link the ecological with the other criteria related to the social, economic and governance concerns (e.g. using the WCPA 2002 M&E criteria). The challenge then is to sustain the project impacts in the various criteria of effectiveness and sustainability by enhancing the complementation of all the aspects of the fisheries through the synergy of their components as manifested in ecosystem management multiple dimensions.

Summary and recommendations

1. A review of the current, doable and globally accepted best practices on baseline assessment, approaches and techniques is a necessary first step to provide the context and purpose of the baseline assessment.
2. The need for fishery independent techniques to arrive at the project performance indicators was emphasized.
3. These indicators should be taken in complement with other contextual information and to be integrated in a logical framework.
4. Its purpose is to gauge management effectiveness, and its impact and understand the nature of the processes of the fisheries management ecosystem regime.

5. The challenge is to be able to use this information, with its lessons and shared experiences to enhance the implementation of effective management of the FISH project sites.

3.2 Synopsis of First Workshop and other consultations with the FISH project

The first workshop consultation with the FISH project (24-25 November 2003) came to some agreements on the need for fishery independent techniques to be employed in the base assessment (see Appendix D-1).

The importance of an integrated framework to deal with questions of scales appropriate to the ecosystem management area was discussed. Spatial and temporal scale considerations are linked to the types of management interventions of the contractor. In addition, the levels and types of interventions are linked to the indicators that will serve as handles for specific questions and yet can be integrated in an overall ecosystem management and project context.

Leveling off on the objectives and criteria for the choice of focal areas and target sites together with their appropriate schedules for the baseline assessment were agreed upon. These provided on the ground day to day operational concerns, and general entry procedures, experimental design protocols and feedback mechanisms.

3.3 The Baseline Contractor Site Assessment Report

The site report description submitted in 19 July 2004 is attached (Appendix A and B). In this section, we provide the executive summary and some synthesis papers (Sec.3.3.1-3.3.6) together with insights and recommendations (3.3.7). The subsections (Sec. 3.3) show the importance of interrelating some components in the site report (e.g., habitats and fisheries), in order to understand the context of the present status, conditions and threats of the area. Sec. 3.3.6 provides an example of a synthesis model that might be utilized to integrate various inputs derived from the site report. We provide an integrated summary and recommendations on how the site report to the objectives of the integrated baseline assessment workshop (Sec.4) and to the performance monitoring evaluation as detailed in Sec.5.

Below is the revised executive summary of the site assessment report:

The goal of improving fisheries production and sustaining fisheries is a laudable yet challenging aspiration. As an independent baseline contractor providing the benchmark situation for the performance evaluation of the FISH project provides an independent gauge of impact and performance. This is linked to the award of an incentive for achieving the performance targets of 10% increase in fisheries stocks. The context of this objective is primarily based on the biophysical measure of project outcomes (Project Result Indicators [PR] 1- 4 as proposed by the FISH contractor. PR 1 is based on catch rate estimates [Catch per Unit Effort (CPUE)] based on fishery independent estimates; PR2 is based on catch rate estimates gauged from fishery dependent techniques; PR3 is based on fish density and biomass estimates from coral reefs inside and adjacent to marine sanctuaries being established or provided technical assistance by FISH; and the PR4 is based on the percent of living coral cover improved within and adjacent to the MPA FISH project intervention area. The DAI-baseline contractor provides the initial site characterization report as the discussion point with the FISH contractor. *[Note: PR 4 used to be benthic cover but became PR5 in the 29 July 2004 PMP report of FISH with the inclusion of reef fish species richness inside and outside the MPA, thereafter referred to as PR4].*

In the site report, six barangays were sampled for each focal site in the target municipality. Catch rate estimates for PR1 were made through fisher survey interviews complemented with focus group discussions made at each barangay. Only two municipalities (Talibon, Bohol and Culion, Palawan) were sampled for fishery independent techniques, PR1. For Talibon, Bohol crab pots and beach seine were used to sample randomized grids. On the other hand, Culion, Palawan was sampled using hook and line and longline fishing techniques at randomly assigned grids due to the importance of evaluating the grouper based live food fish trade. Fish visual census estimates were made with actual abundance and size count estimates within a 500 m² as a measure for PR3. Size and abundance counts were made at every 2.5 meters at each side of the 5m intervals within the 50m transect line. Line-intercept transect observations of lifeform benthos *sensu* English et al. (1997) were made and documented and cross calibrated using underwater video records read at the lab. Maps of the various habitats were made based on the image analyses of the most recent appropriate satellite images available. Mangrove and seagrass habitat characterization was undertaken for retrospective analyses of the productivity of the samples and its eventual calibration of top down and bottom modeling.

Bongao, Tawi-Tawi is the most diverse (based on underwater fish census estimates at around 55-65 species per 500m²) and the most productive ecosystem among the four target sites. Modal size of target species were around 15cm giving an estimated biomass of around 20-25 tons km⁻² and a density of around 600 fish per 500 m⁻²). Live coral cover were generally fair and some good areas and its relative condition index is fair (Gomez et al., 1994). Thirty-five fishing gears types were recorded. Catch rates derived from the

different fishing gears with affirmation from at least 10 respondents were the basis for the estimates of the most common gears at each barangay. Only the CPUE based on interviews for the two most common gears are reported, i.e. pukot “gill net” and bingit “hook and line”. CPUE estimates are: For Pukot “gill net” is $1.68 \text{ kg fisher}^{-1} \text{ hr}^{-1}$ and Bingit “hook and line” were estimated at 1.63 kg hr^{-1} .

Cortes, Surigao is similar to Talibon. Based on underwater fish census estimates at around 33-43 species 500 m^{-2} and an average of less than 5 tons km^{-2} . Modal sizes of target species were around 11-12 cm giving an estimated biomass of around 5-7 tons km^{-2} and a density of less than 400 fish 500 m^{-2} . Live hard coral cover is generally fair to good and its relative condition index is good. Twenty-six fishing gears types were recorded. CPUE estimates are: For Pukot “gill net” is $0.36 \text{ kg fisher}^{-1} \text{ hr}^{-1}$ and Bingit “hook and line” were estimated at 0.43 kg hr^{-1} .

Culion, Palawan is also quite diverse (based on underwater fish census estimates at around an average of 45 species 500 m^{-2}) and nearly as productive ecosystem as Bongao. Modal size of target species were around 13 cm giving an estimated biomass of around 20- 30 tons km^{-2} and a density of around 1,000 fish per 500m^{-2} . Live hard coral cover is generally poor to fair and its relative condition is generally fair. Thirty-one fishing gears types were recorded. CPUE estimates are: For Pukot “gill net” is $0.70 \text{ kg fisher}^{-1} \text{ hr}^{-1}$ and Bingit “hook and line” were estimated at 0.92 kg hr^{-1} . Fishery independent fishing activity estimated catch rate for pasol “hook and line” is $3.07 \text{ kg trip}^{-1}$ while bottom-set longline estimates showed $5.12 \text{ kg trip}^{-1}$ or estimated at $1.45 \text{ tons km}^{-2}$.

Talibon, Bohol seems to be the least diverse. Based on underwater fish census estimates at around an average of around 23-30 species per 500m^{-2} . Modal size of target species was around 11-12cm giving an estimated biomass of around less than 5 tons km^{-2} and a density of around 200-300 fish per 500m^{-2} . Live hard coral cover is generally poor to fair and its relative condition index was variable from poor to good. Forty fishing gears types were recorded. CPUE estimates are: For Pukot “gill net” is $0.73 \text{ kg fisher}^{-1} \text{ hr}^{-1}$ and Bingit “hook and line” were estimated at 0.87 kg hr^{-1} . Fishery independent fishing activity estimated catch rate for crab pots is $0.39 \text{ kg trip}^{-1}$ while beach seine estimates showed $2.64 \text{ kg trip}^{-1}$ or estimated at $0.26 \text{ tons km}^{-2}$.

Mangrove and seagrass retrospective analyses suggest that choice of sites for some target fisheries is important for particular habitat associated species. Seagrass beds in Cortes, Surigao del Sur were more speciose (8 species) than the other areas. Despite being generally narrow, the seagrass meadows in Bongao, Tawi were remarkably rich in large-sized associated fisheries species. In Talibon, some mangroves planted in seagrass areas showed poor growth performance. Talibon shows the most extensive seagrass, sand and mixed soft bottom area. Most of the mangrove stands are *Rhizophora* whereas in Bongao most of the stands are dominated by *Sonneratia alba*. Culion seems to have the most extensive mangrove (18.8 km^{-2}) cover followed by Talibon (15.1 km^{-2}). Though the coral

reef areas seem to be the most productive fisheries habitat, its coverage is the least of all habitats (total from the 4 sites is only 25km² or only 11% of all the habitats covered).

Overall, despite the seemingly good condition for Bongao and Culion all the FGD sites yielded declining fish yields and shifts in fishing activity towards more efficient gears. In addition, fishers in most of the area are in dire straits with average daily incomes being reported to be as low P 70 in Bongao. In Cortes, Surigao, highly seasonal fishing may also constrain improving net incomes. Consistent reports of lower catch in all sites for high-valued species, such as groupers and lobsters. In general, lower levels of awareness on CRM is seen in Bongao with the most level of interventions in Talibon but remains to have the intense destructive fishing activity.

3.4 Related Papers

In the succeeding sections, discussions on the various ways to analyze related ecosystem components are presented. One subsection (3.4.1) provides an analysis on the correlation of the fish abundance and benthic attributes is presented. In addition, the seagrass and mangrove characterization shows the importance of these habitats, not only in relation to hindcasting environmental factors in the area, but also its importance to gauging overall fisheries productivity potentials (Sec. 3.4.2). The gears association subsection (Sec.3.4.3), implicates the significance of knowing how fishers operate in the area and the importance of spatially explicit characterization of fishing activity. Also important is to highlight the relevance of survey interviews and focus group discussions (Sec.3.4.4) in providing context to the various fisheries information such as the fishery independent techniques (Sec. 3.4.5). A integrative approach using a simulation model was used to explore the possible implications of the various site catch rates and coral reef area information to size of MPA needed to sustain the present levels of fisheries yield.

3.4.1 Habitat-gear use associations in the FISH study sites

Introduction

Fisheries management interventions to improve fisheries stocks to a more sustainable level are being implemented in a variety of space scales. In most cases, management measures do not fully take into account spatial behavior of fishermen and the spatial distribution of fishery resources. Fishery assessment methods sometimes assume, at least initially, no spatial dimension and that the “dynamic pool assumption” will eventually homogenize past fishing efforts throughout the stock (Caddy and Carochi 1999). Marine ecosystems have a strong spatial dimension and in the context of fisheries assessment, it is important to know how fish population density and fishing effort variations in space are shaped by biological, economic and oceanographic factors.

An example of an interplay between biology and economics is a model describing how fishing effort increases with increasing distance from the coast (at least for municipal fishers who go out on trips lasting not more than a day). This suggests that the higher fishing intensity closer to the coast would deplete resources there such that fishers would have to move farther out to sea in order to maximize their returns. Theoretically, the distance from the coast where the peak in fishing effort is found may be taken as the area where maximum returns can be obtained. Thus the spatial distribution of fishing effort can also serve as an indicator of the state of nearshore resources. At an initial state, the fishing effort distribution is decreasing from the coast but as the nearshore resources get depleted, the distribution shifts to a Gaussian one where the peak progressively moves farther offshore with time. In a multi-species fishery, such as in the Philippines, the shift in the locations of fishing effort may also mean a shift in the gear used and catch composition.

In this report, we examine the relationships between gear use and location of coastal habitats (corals, sea grass, and mangrove). Comparison of these relationships for the different study sites may provide insights into relative differences in fisheries resources and degree of exploitation. In addition, the spatial distribution of fishing effort may also be useful in scaling up survey data to derive spatially integrated fishing effort and production in all four sites.

Methods

The data used in this analysis were obtained from fishery interviews conducted in four different municipalities (Talibon, Bohol; Bongao, Tawi-tawi; Cortes, Surigao del Sur; and Culion, Palawan). In the interviews, fishers were asked to indicate on a map where they fish, the gears that they use and composition of their catch. The number of respondents for each municipality is summarized in Table 1. For this study, it is assumed that the gear maps represent the spatial distribution of fishing effort.

Results and Discussion

The mean distances between fishing gear location and coastal habitats are very different for each of the study sites (Figure 1). The largest distances (>4km) are found in Bongao and Cortes while Culion and Talibon both have mean distances less than 2km from coastal habitats. In Culion and Talibon, where average distance is less than 2km, the fishing effort decreases exponentially with distance from the habitats. Almost 50% of the effort is within 1km from the habitats (Figure 2). Intuitively, such trends are expected in areas where reef-associated fishery is significant.

In contrast, the fishing effort within a 1km distance from the habitats is significantly less in Bongao (20%) and Cortes (10%). Such exponential decrease in effort was not observed in Cortes and Bongao, which may also indicate the nature of the fisheries in these areas where the pelagic fisheries is also a major contributor. Catch composition and gear inventory data also from the same areas show that gillnets dominate the gears used in Cortes catching mainly pelagic fish. In Bongao, large distances between gears and habitats may be related to the presence of a large 20km wide lagoon south of Bongao, which is a major fishing area for the fishermen from Bongao.

Note that the fishing effort distribution shown in Figure 2 combines all gears and their respective distances to the different habitats. Disaggregating fishing effort to 3 general classes of gear (gillnet, hand instruments and lines) and calculating the distribution of effort with each of the different habitat types show site-specific characteristics. For instance, the plot in Figure 3 shows that the average distance between 3 types of gear and habitats characterized by a mixture of seagrass, sand and rubble does not vary

significantly between gears but is significantly different between sites. On the other hand, the average distance between the gears and coral habitats show more variations between gears (Figure 4). These differences probably reflect the fact that most gears are designed to capture targeted species and if these target species prefer certain types of habitats, the gear-habitat distances will certainly exhibit differences.

Fishing effort distributions can also give provide insights on the influence of habitats on fishing behavior similar to the approach used to model fishing effort. A simple model of fishing effort is the friction of distance where effort can be expressed as

$$E = f\left(\frac{1}{d^n}\right) \quad (1)$$

where E is effort, d is distance from coast or habitat and n is the friction of distance. The friction of distance concept also assumes that the degree of spatial interaction decreases with distance. Increasing values of n suggest higher influence of the habitat on a particular gear (Figure 5).

The effort distribution for gill nets relative to the “mixed” habitat class (Figure 6) and coral reef habitat (Figure 7) suggests that the relative influence of habitats on effort varies with gear and with area. For gill net effort relative to seagrass-sand-rubble mixture, the influence is highest in Talibon, followed by Culion, Cortes, and Bongao. For coral association, the highest influence is in Culion followed by Bongao, Talibon, and Cortes.

Summary and Conclusions

Fishing effort spatial distributions were derived from gear maps obtained from fisher interviews. These distributions provide useful information which can help in defining extents of fishing areas and additional insights on the degree of dependence of fishing on particular habitats but can also be used to infer fishing behavior and enable complementary insights to the usual, no spatial context, catch per unit values. Information on the spatial distribution of effort, together with other factors such as the status of the resource, gear efficiency and fishing skill will contribute towards the understanding of the dynamics of the resource use patterns. Spatial information on effort and habitat associations is important considerations in designing management interventions that are usually spatially explicit. For instance, estimating impacts of effort reduction and zoning will be much easier if spatial effort information is available. Of course, other information on the habitats will also have to be considered such as

vulnerability and sensitivity maps in conjunction with species composition, distribution and relative abundance of target species.

References

Caddy, J.F., Carocci, F., 1999. The spatial allocation of fishing intensity by port-based inshore fleets: a GIS application. *ICES J. Mar. Sci.* 56, 388–403.

Table 1. Number of respondents for gear map interviews

Municipality	Num of Respondents
Talibon, Bohol	257
Bongao, Tawitawi	489
Cortes, Surigao del sur	595
Culion, Palawan	221

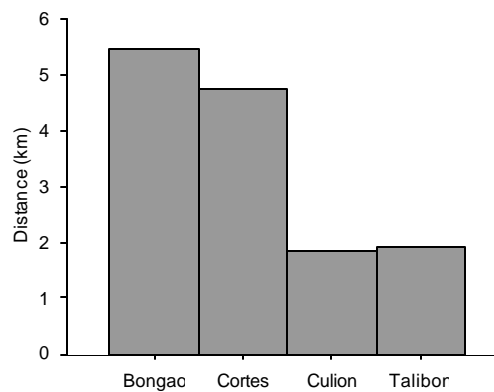


Figure 1. Average distances between gear location and nearest habitat for the four study sites.

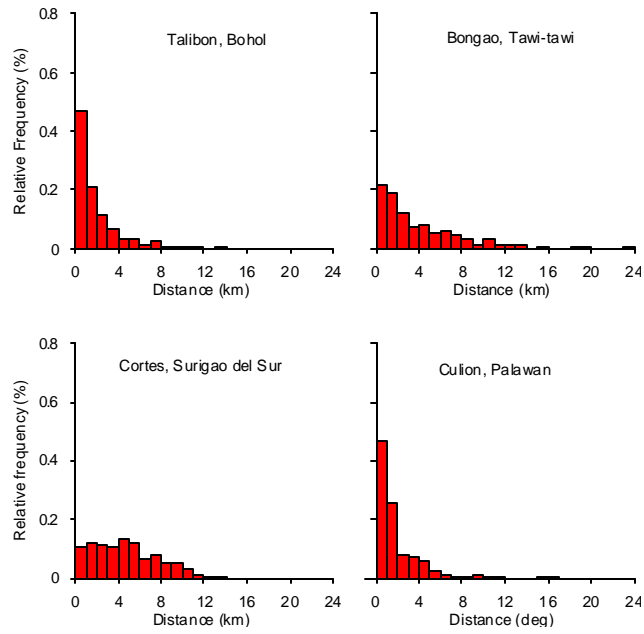


Figure 2. Frequency distribution of distances between all gears and all habitats

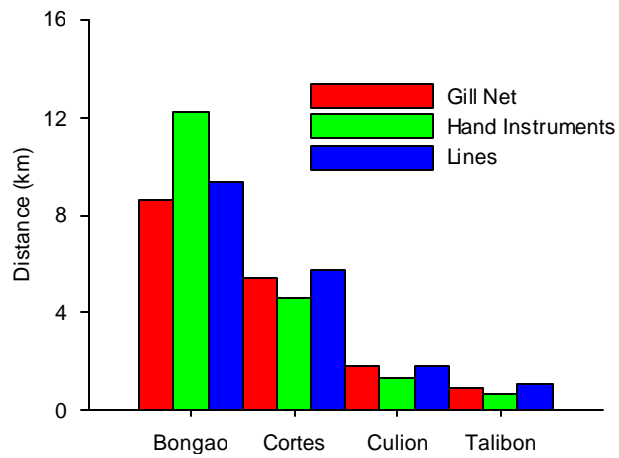


Figure 3. Average distances between three types of fishing gear with habitats characterized by a mixture of seagrass, sand and coral rubble.

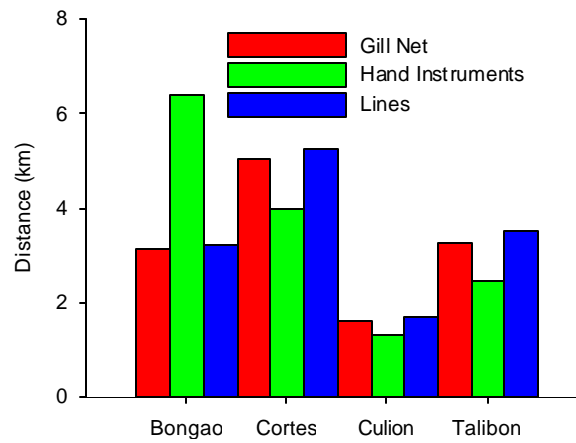


Figure 4. Average distances between three types of fishing gear with coral habitats

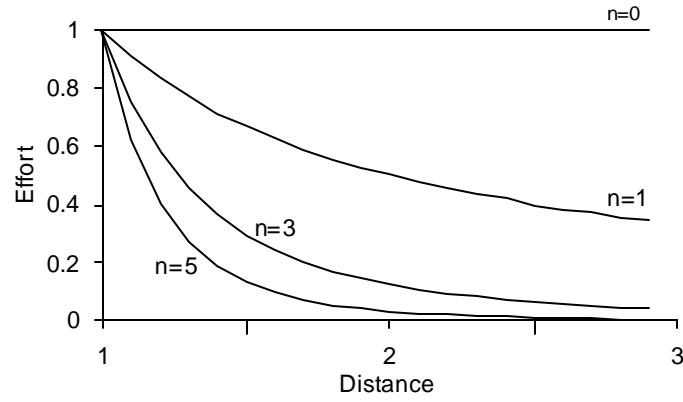


Figure 5. Hypothetical relationship between effort and distance from habitat for different values of n (friction of distance).

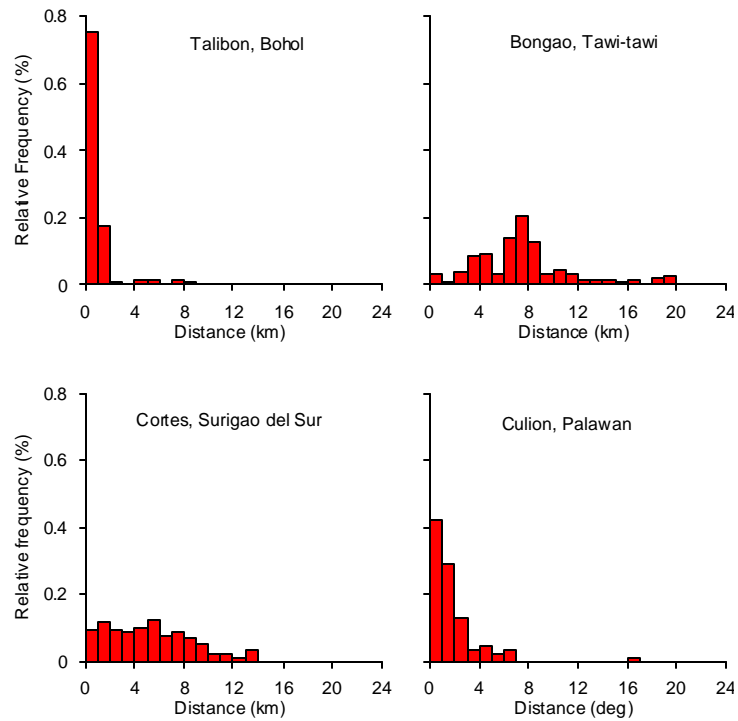


Figure 6. Relative frequency distribution of the distances between gill net locations and habitats characterized by seagrass, sand and rubble.

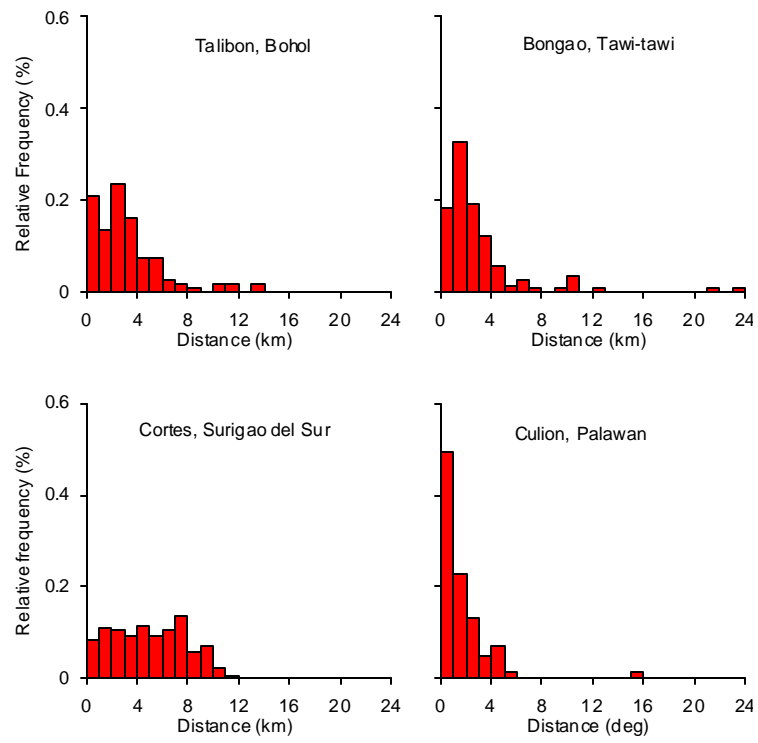


Figure 7. Relative frequency distribution of the distances between gill net locations and coral habitats.

3.4.2 Seagrass and Mangroves

Seagrasses

At the four focal sites (Talibon, Bongao, Cortes and Culion), seagrass beds were surveyed. For the details on the results of these surveys, separate site reports had been made (see Appendices C-5). Overall, the number of sampling stations per focal site (Table 1) ranged from 7 (Cortes) to 13 (Bongao). The number of seagrass species found at these focal sites did not differ much (range: 8-9; Table 1), although variation among sampling stations within the focal sites could be wide, ranging from 1 to 8 (Table 1). Cortes and Culion appeared to have, respectively, the highest (5.7 ± 0.68) and lowest (3.6 ± 0.69) mean number seagrass species present per station (Table 1). The estimated aboveground biomass values (range: $97.3 - 200.7 \text{ g DW m}^{-2}$; Table 1) were all lower than Bolinao benchmark ($345.6 \text{ g DW m}^{-2}$; Vermaat et al. 1995): Cortes (200.7), Talibon (144.1), Culion (113.4), and Bongao (97.3). The contribution of the *Thalassia hemprichii* (the seagrass species studied in more detail; see also Table 3) was $< 5\%$ (Table 1), except in Talibon (27%). The estimated annual aboveground productivity (Table 1) of these focal areas followed ranking the same as biomass: Cortes ($3821.6 \text{ g DW m}^{-2} \text{ y}^{-1}$), Talibon (2406.7), Culion (1435.8), Bongao (1036.2) with *T. hemprichii* contributing from 33 – 69%. These aboveground productivity levels were comparable with published values (Bolinao, $2032.3 \text{ g DW m}^{-2} \text{ y}^{-1}$, Vermaat et al. 1995; Pag-asa Island, 1942.5, Rollon et al 2001).

Combining the information on seagrass productivity at the focal sites with the corresponding total area of seagrass beds (quantification details are found in the remote sensing and habitat mapping section of Appendices C-5), and assuming roughly that 10% (wet basis) of such production values may be translated to fisheries, the potential fisheries yield which may be derived from seagrass beds at the focal sites could be approximated (Table 2): Talibon (22, 381.4 mt y^{-1}), Cortes (16,050.7), Culion (9,476.3), and Bongao (3,454.0). Such ranking of the sites however appeared to be in contrast to that of the corresponding biomass of reef fishes (see also Appendices C-5), which may mean that stresses on the fish stock other than the habitat conditions (e.g. level of fishing pressure, etc) may be stronger.

Looking at the populations of *T. hemprichii* in more details, the balance (R_{net}) between the gross recruitment and mortality at any of the focal sites was $< 0.1 \text{ ln units y}^{-1}$ (Table 3): Culion ($-0.447 \pm 0.109 \text{ ln units y}^{-1}$), Talibon (-0.216 ± 0.061), Bongao (-0.198 ± 0.042), and Cortes (-0.162 ± 0.108). This may mean that, overall, these *T. hemprichii* populations (which contribute about 33-69% of the annual aboveground productivity; Table 1) are declining, though within sites, some meadows were still strongly expanding, i.e., $R_{\text{net}} > 0.1 \text{ ln units y}^{-1}$ (Table 3). Flowering effort of the species was $< 10\%$ of the total number of individuals sampled, with Talibon having the highest mean value ($8.27 \pm 3.19\%$, ranging from 0-34%; Table 3). At the other focal sites (Bongao, Cortes, Culion), no flowering effort $> 15\%$ was found at any of the sampling stations.

The elongation rate of the vertical rhizome of *T. hemprichii* at any of the focal sites was $< 5 \text{ cm y}^{-1}$ (Table 3), with no particular meadow exceeding $6.5 \text{ cm sht}^{-1} \text{ y}^{-1}$ (maximum: 6.7

cm sht⁻¹ y⁻¹, Cortes). This may indicate that most of these *T. hemprichii* would not be able to cope with sedimentation rate > 6.5 cm y⁻¹, as the shoots would die when their meristems are buried. Curiously, the focal sites having the slowest (Talibon, 2.83 ± 0.83 cm sht⁻¹ y⁻¹) and fastest (4.16 ± 0.48) vertical elongation rates also had, conversely, the highest (8.27 ± 3.19%) and lowest (4.56 ± 1.74%) flowering effort. The mean horizontal elongation rates of the creeping rhizomes were mostly about 50 cm apex⁻¹ y⁻¹ (Bongao, 53.52 ± 3.39; Cortes, 49.17 ± 5.02; Talibon, 48.89 ± 3.33; Table 3), with Culion meadows being comparatively slower (41.27 ± 5.18).

The magnitude of the apparent and past flowering events in *T. hemprichii* (Table 3; see also Appendices C-5) appeared to differ across the focal sites. Across time however, trends appeared parallel. In general, peak in flower initiation occurred during Nov-Feb period, a profile closely similar to elsewhere in the country (Bolinao, NW Philippines; the Kalayaan Island Group; Western Visayas; eastern Philippine seaboard). Such close similarity in the reproductive timing should prove useful in designing seagrass restoration efforts based on seedlings instead of destroying existing meadows as donor sites.

Mangroves

We surveyed the mangrove forests at the focal sites (Talibon, Bongao, Cortes and Culion), with the total number of sampling station per focal site ranging from 5 to 9 (Table 4). Similar to seagrasses, the details of the results are contained in separate site reports (Appendices C-5). We found the highest number of mangrove species (13) in Bongao, though the lowest average tree density (2,401 ± 655 individuals ha⁻¹) was also found at the site. The mangrove forests in Talibon were afforestation of mainly *Rhizophora apiculata*. Thus, on average, this focal site had the lowest average number of species (3.11 ± 0.70) present at a particular sampling station. Exceptionally, the number of species in Bamanan Island (Talibon) was 8. Incidentally however, the greater part of the island has been converted into fish ponds. Because mangrove forests in Talibon were mostly afforested (a number of which were on seagrass beds), this focal site had the densest mangroves (5,497 ± 1722 trees ha⁻¹, but may reach up to > 16,000 stems ha⁻¹ in Cataban island; see also Appendix C-5). The corresponding basal area (74.63 ± 23.53 m² ha⁻¹) however was much lower than those of Bongao (119.21 ± 42.86) and Cortes (111.55 ± 23.53). The latter sites, though having lower stem densities (2,401 ± 655 and 4,550 ± 840, respectively), had the large-sized mangrove species including *Sonneratia* and *Avicennia*, in contrast to the mostly monospecific forests of thinned *Rhizophora* in Talibon. The mangrove basal area in Culion (19.23 ± 2.40 m² ha⁻¹) was the lowest, also mainly attributable to the predominance of the thin *Rhizophora* trees (e.g. in Baldat where stem density was > 9500 stems ha⁻¹). The abundance of mangrove seedlings at the 4 focal sites was about equal (range: 7 - 9 m⁻²; Table 4). In total, the municipality of Culion had the widest area (18.8 km²) covered by mangroves, followed by Talibon (15.1), Bongao (9.8), and Cortes (5.8).

The reconstruction of the growth patterns of young (< 10 years old) *Rhizophora* (*R. apiculata* and *R. mucronata*) mangroves showed strong spatio-temporal and inter-specific differences (see also Appendices C-5; temporal variation in internodal lengths). It was

clear though that *Rhizophora* mangroves growing on muddy substrates along the coastlines of larger islands had faster growth rates than those stunted mangroves planted in small islands having coarse, sandy substrates. Hence, the appropriateness of mangrove afforestation in such coarse islands and sandbars may be reviewed, especially when such plantation are on existing seagrass beds. The apparent interspecific differences in the growth patterns of *R. apiculata* and *R. mucronata* may reflect difference environmental signals. Hence, utilizing both mangrove species might be ideal for future monitoring work.

Fisheries-related indicators

Among the major roles played by seagrass meadows and mangrove forests are spawning, nursery and feeding grounds, although large-sized, commercially important fauna may not really be resident in these habitats. Hence, habitat indicators that could be related to fish stock (pelagic and demersal groups) are, at best, indirect. Assessment of associated fauna in these habitats would be directly helpful, and thus, might have to be included in future work. But since most of these fish and invertebrate fauna are only transients, otherwise cryptic, comprehensive surveys would also prove difficult. Relating primary production to potential fisheries yield would therefore be the best option. Hence, doing calculations similar to those shown in Table 2 and quantifying the relevant input parameters (e.g., habitat size, species present, growth rates of the different species, demographic status, etc.) would be most useful. For mangroves, parallel calculations would be more difficult (but see for instance Duarte et al., 1999; Coulter et al., 2001). In this connection, the temporal profiles in growth patterns of *Rhizophora* mangroves as provided earlier (see Appendices C-5) would contribute substantially.

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Table 1. Overall summary of seagrass parameters determined at the four study municipalities: Talibon, Bongao, Cortes and Culion. As the seagrass *T. hemprichii* was studied in more detail (see also Table 3), its relative contributions to the total aboveground biomass and annual productivity are also shown (items C and D).

Parameter	Talibon	Bongao	Cortes	Culion
A. number of sampling sites	10	13	7	11
B. Number of seagrass species				
total	9	8	9	9
mean \pm se	4.0 \pm 0.56	4.2 \pm 0.45	5.7 \pm 0.68	3.6 \pm 0.69
range	4 - 8	2 - 7	3 - 8	1 - 7
C. Aboveground biomass, g DW m ⁻²				
total	144.1	97.3	200.7	113.4
% contribution of <i>T. hemprichii</i>	27.0	2.5	1.2	2.3
D. Estimated annual productivity, g DW m ⁻² yr ⁻¹				
total	2,406.7	1,036.2	3,821.6	1,435.8
% contribution of <i>T. hemprichii</i>	69.2	32.7	59.2	60.1
biomass : productivity ratio	16.7	10.6	19.0	12.7

Table 2. Estimated annual productivity and the potential municipal fisheries yield which may be derived from the seagrass beds at the four study locations: Talibon, Bongao, Cortes and Culion.

Parameter	Talibon	Bongao	Cortes	Culion
A. Estimated annual productivity, g DW m ⁻² yr ⁻¹	2,406.7	1,036.2	3,821.6	1,435.8
B. Estimated annual productivity, g WW m ⁻² yr ⁻¹ (or mt WW km ⁻² yr ⁻¹)	8,022.3	3,454.0	12,738.7	4,786.0
C. Potential fisheries annual yield (assume 100% is eaten; 10% B), mt km ⁻² yr ⁻¹	802.2	345.4	1,273.9	478.6
D. Total area of seagrass meadows, km ² (image analysis)	27.9	10.0	12.6	19.8
E. Municipal total potential annual fisheries yield, mt yr ⁻¹	22,381.4	3,454.0	16,050.7	9,476.3

Note:

Because most of the seagrass biomass would be detritus or exported, potential yield (C) is probably overestimated. Relatively however, comparisons between sites may be less sensitive to this error.

Table 2. Estimated annual productivity and the potential municipal fisheries yield which may be derived from the seagrass beds at the four study locations: Talibon, Bongao, Cortes and Culion.

Table 3. Summary of the parameters studied in more detail for *T. hemprichii* in the four study locations: Talibon, Bongao, Cortes and Culion.

Parameter	Talibon	Bongao	Cortes	Culion
A. Estimated annual productivity, g DW m ⁻² yr ⁻¹	2,406.7	1,036.2	3,821.6	1,435.8
B. Estimated annual productivity, g WW m ⁻² yr ⁻¹ (or mt WW km ⁻² yr ⁻¹)	8,022.3	3,454.0	12,738.7	4,786.0
C. Potential fisheries annual yield (assume 100% is eaten; 10% B), mt km ⁻² yr ⁻¹	802.2	345.4	1,273.9	478.6
D. Total area of seagrass meadows, km ² (image analysis)	27.9	10.0	12.6	19.8
E. Municipal total potential annual fisheries yield, mt yr ⁻¹	22,381.4	3,454.0	16,050.7	9,476.3

Note:

Because most of the seagrass biomass would be detritus or exported, potential yield (C) is probably overestimated. Relatively however, comparisons between sites may be less sensitive to this error.

Parameter	Study area			
	Talibon	Bongao	Cortes	Culion
Horizontal expansion rate	48.89 ± 3.33 (35.6 - 64.2)	53.52 ± 3.39 (23.86 - 66.79)	49.17 ± 5.02 (35.98 - 70.93)	41.27 ± 5.18 (25.65 - 70.07)
Vertical elongation rate	2.83 ± 0.23 (2.32 - 4.19)	3.09 ± 0.21 (2.14 - 4.53)	4.16 ± 0.48 (2.47 - 6.37)	3.98 ± 0.17 (3.23 - 4.87)
Flowering effort, %	8.27 ± 3.19 (0 - 34.9%)	6.16 ± 1.01 (0.89 - 15)	4.56 ± 1.74 (0.94 - 14.04)	6.76 ± 1.47 (0 - 14.91)
Net recruitment, ln units y ⁻¹	-0.216 ± 0.061 (-0.460 to 0.059)	-0.198 ± 0.042 (-0.402 to 0.248)	-0.162 ± 0.108 (-0.435 to 0.355)	-0.447 ± 0.109 (-1.039 to 0.062)
Number (%) of sites with R _{net} > -0.1	4 (40.00)	1 (7.69)	3 (42.86)	1 (11.11)

Table 4. Overall summary of mangrove parameters determined at the four study municipalities: Talibon, Bongao, Cortes and Culion. Error terms indicate standard errors.

Parameter	Talibon	Bongao	Cortes	Culion
A. number of sampling sites	9	7	5	9
B. Number of seagrass species				
total	9	13	9	9
mean ± se per sampling station	3.11 ± 0.70	4.29 ± 0.87	4.40 ± 0.68	4.22 ± 0.49
range	1 - 8	2 - 8	2 - 6	2-6
C. Tree density, number of indivs ha ⁻¹	5,497 ± 1722	2,401 ± 655	4,550 ± 840	4,106 ± 788
D. Basal area, m ² ha ⁻¹	74.63 ± 23.53	119.21 ± 42.86	111.55 ± 23.53	19.23 ± 2.40
E. Sapling density, number of indivs 25m ⁻²	6.59 ± 2.25	-	-	-
F. Seedling density, number of indivs m ⁻²	7.35 ± 2.87	8.32 ± 3.76	7.9 ± 1.07	8.83 ± 4.57
G. Total mangrove area, km ²	15.1	9.8	5.8	18.8

3.4.3 Exploring fish and benthos correlations in the FISH focal areas

Introduction

Species richness, counts and biomass abundances are not enough information to describe the status of reef fishes in an area. Observations on the morphology of the reef (i.e. steepness of the slope and reef development), size and extent (i.e. broad or narrow reefs) and its benthic attributes (i.e. lifeform categories) are important to explain the kind of reef fishes that are prevalent in the area. In undisturbed or slightly fished areas, reefs with steep slope, the planktivorous fishes can be dominant but also dependent on exposure to monsoons. An important consideration and objective in the evaluation of the condition of the reef is to be able to discriminate the human induced impacts (such as fishing and siltation) and the resultant state of the reef and their associated fish communities. In this report, exploratory data analyses using the reef fish census and benthic information can be useful in understanding state of the reefs and their potential fishery yield estimates derived on reefs.

Methods

Data were analyzed using multivariate analyses such as canonical correspondence analysis (CCA, Ter Braak 1988) and two-way indicator species analysis (TWINSpan, Hill 1979). For CCA, the fish abundance using counts served as the biotic data and the coral reef benthic lifeform categories served as the “abiotic” data. For TWINSpan, fish abundance data was used. Fish species that appeared only once and with only one individual recorded were deleted in the analyses, except for those species that were known to be rare and with limited distribution range. These are the following species: *Balistoides conspicillum* (Balistidae), *Centropyge ferrugatus* (Pomacanthidae) and *Chaetodon argentatus* (Chaetodontidae). For benthic lifeform categories, only those categories that showed importance based from the initial analysis were used. These benthic lifeforms are: live corals (ACB, ACS, CE, SC), dead corals (DCA), algae (AA, CA, HA), abiotic (R, RCK, S) and other fauna (OT).

Results and discussion

Across comparison among the 4 focal areas surveyed (Figures 1a-1d) showed clear trends for fish species diversity, total abundance and biomass estimates despite the uneven number of sites visited (least for Cortes with only 14 sites and 20 to 22 for the other 3 areas). Culion and Bongao were consistently higher in abundance than Cortes and Talibon for all the parameters measured. The same trend was observed for the species richness and composition of the target fish species but the degree of difference was less except for the estimated biomass (Figure 2). This consistent trend could be attributed to the degree of fishing pressure prevailing in the area, i.e. less fishing intensity in Bongao and Culion as compared to Talibon. However, despite the relatively lower fishing intensity in Cortes than Talibon but definitely higher than Bongao and Culion, the *in situ* estimated biomass of target fishes was relatively low (Nañola et al. 2002). Cortes low biomass may be due to the natural condition of reefs in the area, such as the higher exposure of the reefs to wave surges and frequent typhoons. In fact, the fewer samples made were due to the onset of bad weather conditions during the sampling period.

Results of the CCA analysis using fish abundance as the “biotic data” and benthic attributes as the “abiotic data” (Figures 3a & 3b) showed that there is clustering of sites by focal area or municipality, but with some overlaps except for Culion. Culion is exceptional as seen in the ordination diagram. Its cluster was distinct from the rest of the clusters suggesting high homogeneity of the reefs surveyed. The benthic lifeform category DCA is the unifying factor for this site. Talibon is also showing the same pattern but not as intact as Culion. RCK (rock) and S (sand) were seen as the important factors for Talibon. While, Bongao, Cortes and several sites in Talibon showed some overlap. The overlap suggests close similarities of the sites surveyed despite of their geological and biogeographic differences (see Aliño and Gomez 1994). These sites were composed of the areas situated on the promontories. SC (soft coral) seems to be the unifying benthic fauna for these sites. Lastly, OT (others such as gorgonians) and ACB influence the exposed sites (i.e. Tubig Salang) and inner sites (i.e. Pababag) of Bongao, respectively (see Figures 1a-1d, 3a & 3b).

Based from the species-sample plot and TWINSpan results, these clusters were characterized by certain groups of fishes brought about by evolutionary and ecological processes. Such as the limited distribution of the following species: two species of damselfishes (Pomacentridae: *Altrichthys azurelineatus* and *A. curatus*) in Culion as described by Allen (1999), *Apogon margaritophorus* (Apogonidae) in Talibon, *Centropyge ferrugatus* (Pomacanthidae) in Cortes and *Plectorhinchus polytaenia* (Haemulidae) in Bongao; and the high species diversity of butterflyfishes (Chaetodontidae) in Cortes are all indicators of evolutionary processes.

On the other hand, the ‘absent’ or poorly represented species dominant in high wave energy areas such as triggerfishes (Balistidae) and surgeonfishes (Acanthuridae) in Culion and Talibon (Figure 4) are indicators of some ecological interactions of hydrography and their trophic positions (e.g. planktivores associated with strong current conditions). The low densities of commercially important groups of fishes such as snappers (Lutjanidae), groupers (Serranidae) and wrasses (Labridae) in Talibon and Cortes; fusiliers (Caesionidae) in Talibon and Cortes may be due to fishing pressure. These observations related to intensity of fishing (anthropogenic factors) rather than due to ecological processes as seen in the abundance and dominance of smaller size of fish rather than the dominance of adults (Figure 4). Many fishery biologists have described the latter scenario as indicative of “recruitment overfishing”. However, the observed patterns for the municipality of Cortes need to be treated with caution. During the sampling, exposed reefs were not surveyed due to bad weather. Only those reefs at the channels were sampled (Figure 1b).

Furthermore, it seems to be concordant for those focal areas with high fish biomass estimates observed in the reefs (Figure 2) and showing larger size class of target species (Figure 4) such as in Bongao, to also indicate high fisheries yield potential. This is reinforced particularly by catch rates noted in reef-associated gears such as spear fishing (see also Sec.3.3.4 and Appendix C-5). In contrast, Talibon has the least fish biomass estimates and smaller size class of target species and the least catch rates for spearfishing.

This suggests that the size class distribution of the target fishes obtained using fish census can serve as a corollary indicator for the fishery yield estimates.

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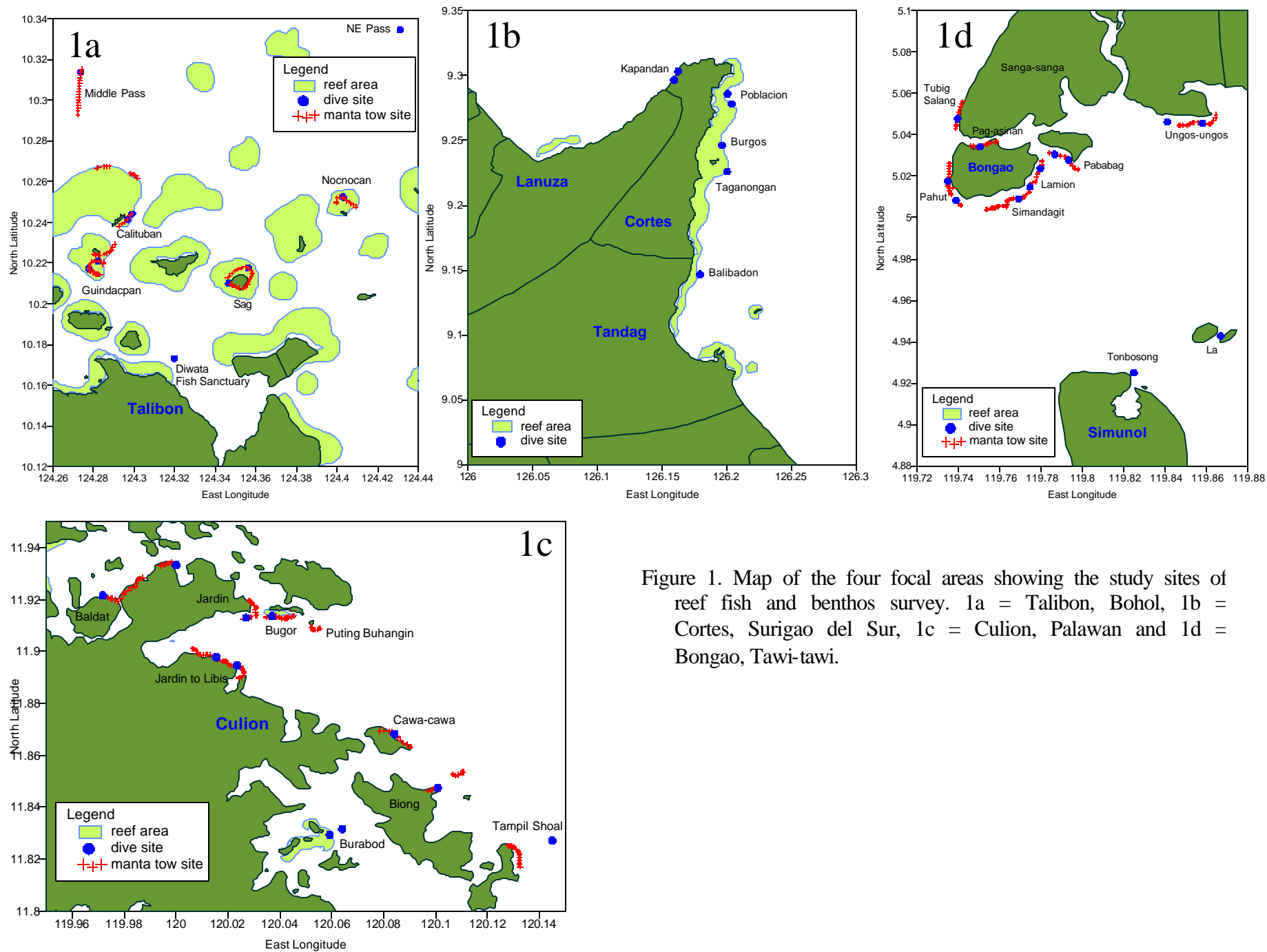


Figure 1. Map of the four focal areas showing the study sites of reef fish and benthos survey. 1a = Talibon, Bohol, 1b = Cortes, Surigao del Sur, 1c = Culion, Palawan and 1d = Bongao, Tawi-tawi.

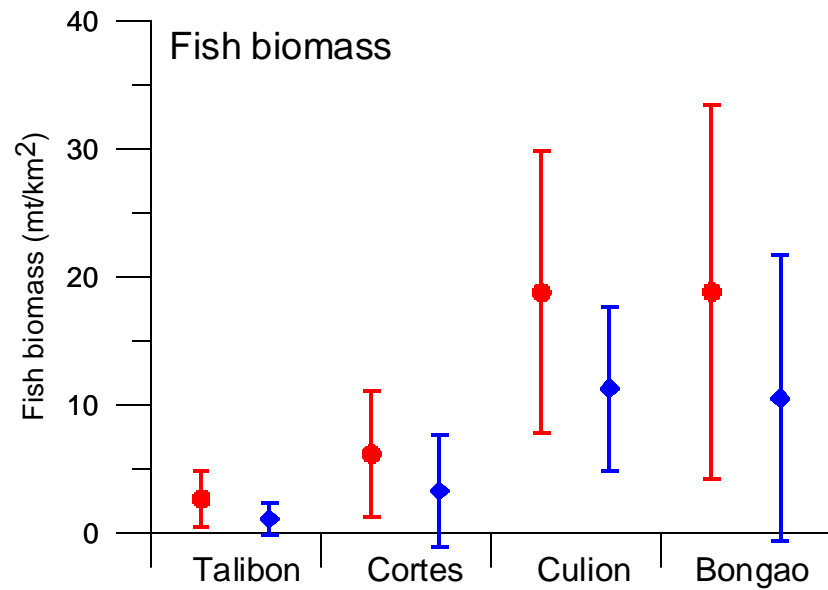
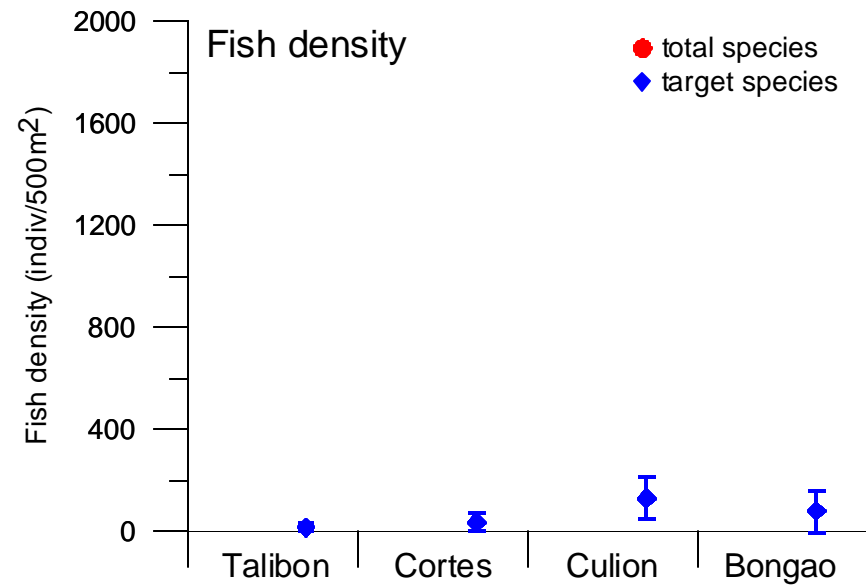
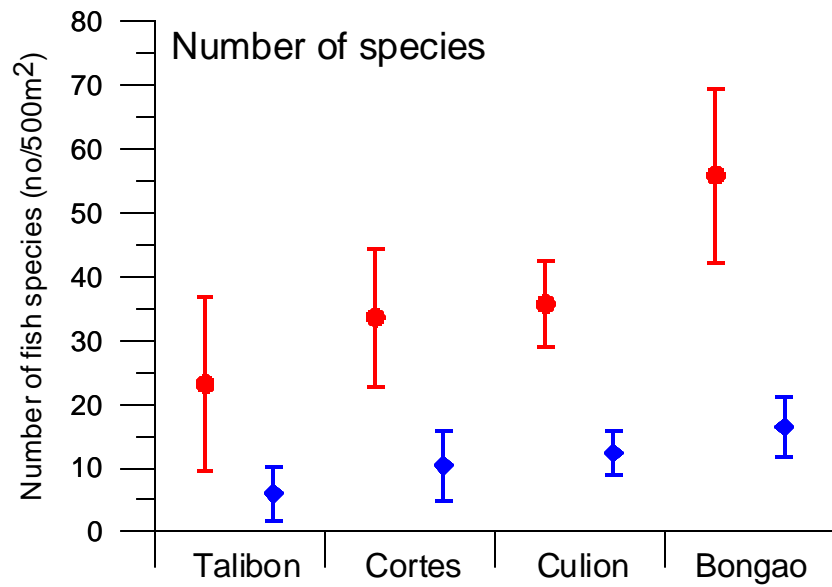
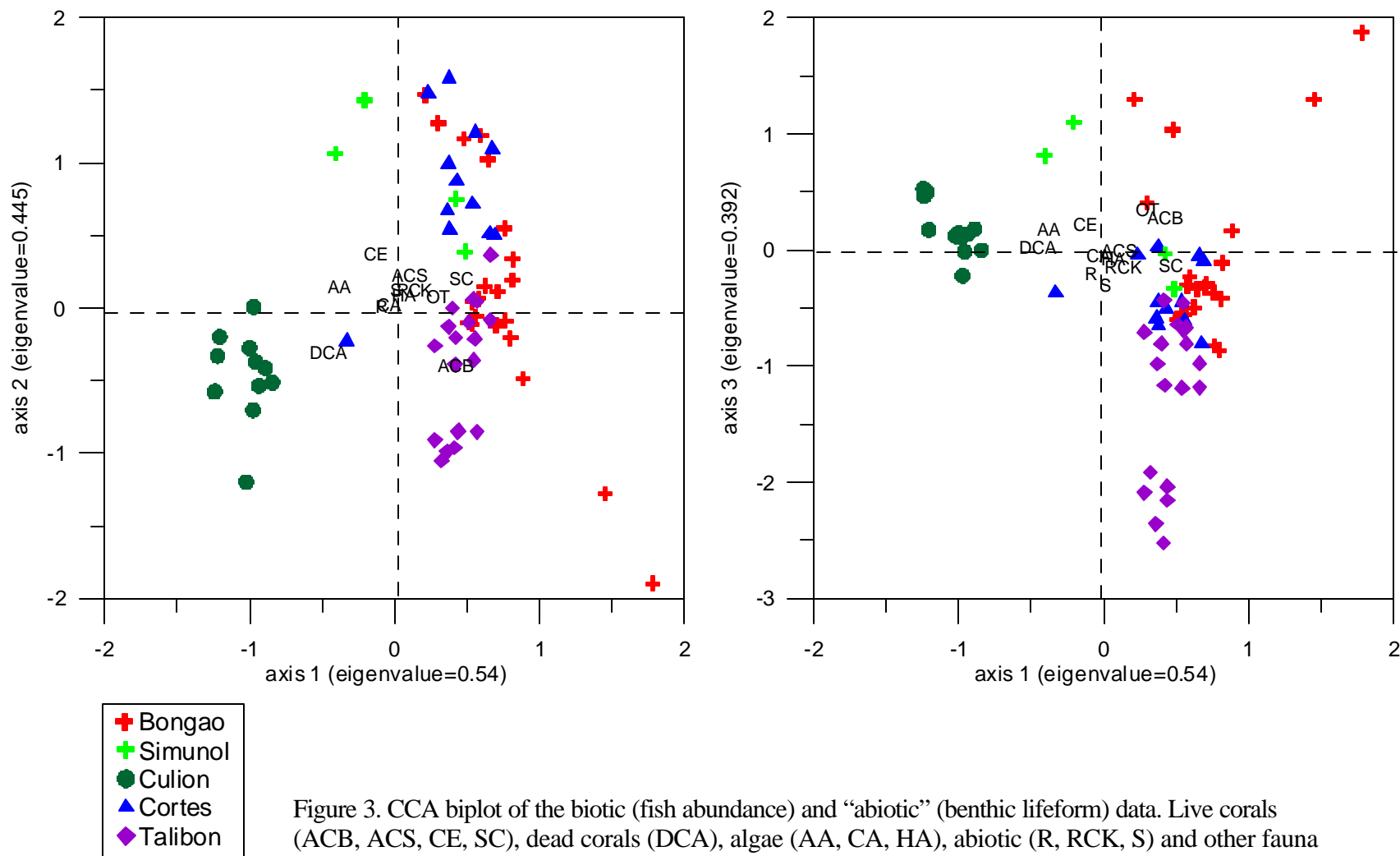


Figure 2. Number of fish species, density and biomass estimates for the four focal areas studied using fish visual census.



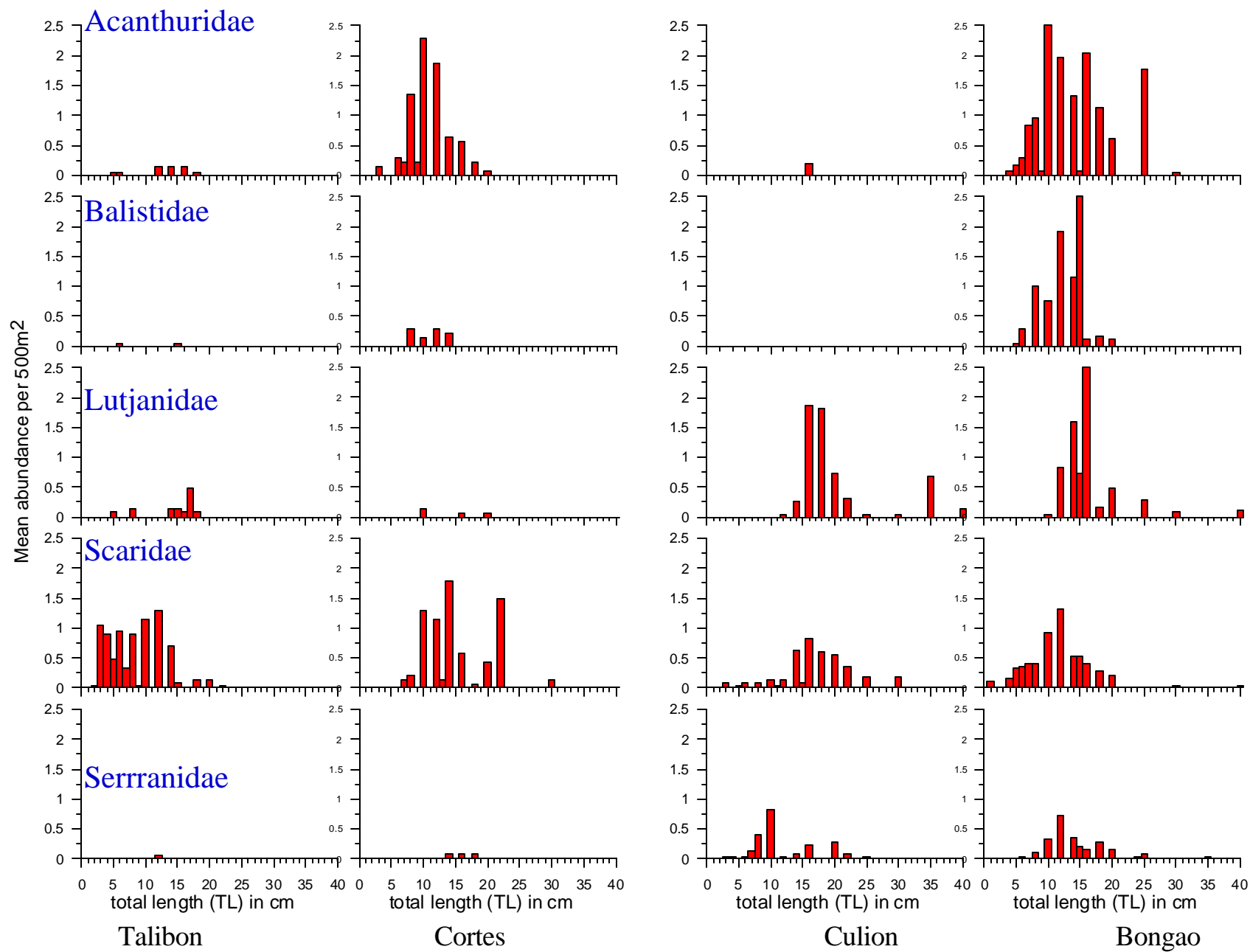


Figure 4. Size frequency distribution of commercially or target reef fishes derived from fish census.

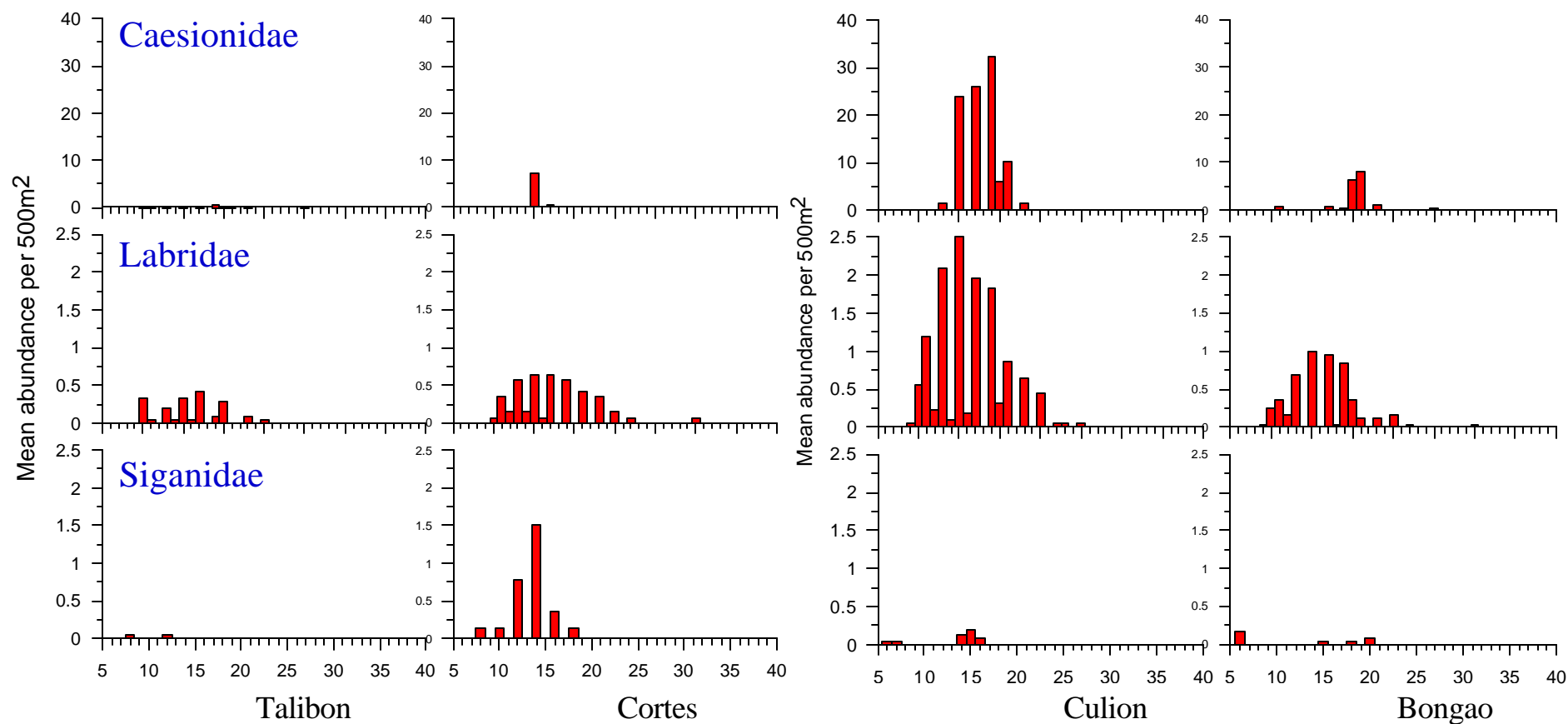


Figure 4. Continued.

3.4.4 Integration of fishery results based on interviews and Focused Group Discussions (FGDs)

Introduction

Like most fisheries in the world, fisheries management in the Philippines is similarly plagued with difficulties. Aside from the biological complexities of stocks i.e. non-linear relationship of spawning stock and recruitment, the nature of artisanal fishing in most coastal villages in the Philippines increases any effort to appropriately manage the fisheries. In particular, it requires rigorous sampling for collection of fishery data in highly populated coastal areas. The FISH Independent Baseline Monitoring Team has undertaken a rapid and intensive collection of baseline data of fisheries and their habitats in 4 focal sites, namely, Talibon (Bohol), Bongao (Tawi-Tawi), Cortes (Surigao del Sur), and Culion (Northern Palawan). These data are crucial for the implementation of the FISH project in its aim to attain an increase in fishery production. To achieve this major goal, a comprehensive approach in fishery management is imperative. The results of this study serve as guide for the project implementer in their performance and success in achieving the goals of the study.

While immediate management interventions exist for most coastal fishing communities in the Philippines, scientific data in fisheries are, however, lacking. This is a major constrain in efforts to heed urgent management calls and science-based protocols may be too long and too late. Thus the precautionary principle in fisheries management is the best alternative. Rapid appraisals for management purposes include participatory approaches where local knowledge of fisheries derived from the fishers themselves is helpful.

This paper describes the semi-quantitative data on fisheries collected in the 4 focal sites and discusses the significance of these data. The fisheries component of the Independent team has collected data on the types of fishing gears at each focal site together with catch rates and spatio-temporal use of these gears. These data were collected through one-on-one household interview with fishers in the 6 pre-selected barangays of each focal site. Parallel interviews using focused group discussions (FGD) were conducted on the same sites to complement with the one-on-one-interview fishery survey. Both these activities also highlight the importance of socio-

economic aspects of the fisheries as this type of information provides a better understanding of the local knowledge of the dynamics in the fisheries.

Types of fishing gears

Household interviews and FGDs held in Talibon were observed to provide similar perceptions of fishers on the type of gears they used. These were observed in the six barangays. Gill nets and their variants were the most commonly used gears, with spearfishing, mainly with the use of compressors (hookah), and fish corrals were also popular gears. Only a few mentioned using hook and line (whether with single or multiple hooks). Seaweed farming, an alternative livelihood to fishing is very active in Talibon with a substantial number of fishers engaged on this activity.

In Bongao, line fishing was the most commonly used fishing activity as noted in the interviews that also included FGDs. Simple handline and lines with multiple hooks were used. A minority of fishers also used gill nets, spears, and traps.

Based on household interview, Cortes respondents appear to use gill net and simple handline more frequently than spears, longline and lines with multiple hooks, fish corral, fish traps and gleaning. On the other hand, FGD activities showed fishers more inclined to carry out gleaning activities and using simple handlines in fishing although use of spears, lines with multiple hooks and gill nets were also mentioned.

Many fishers in Culion seem to engage in line-fishing (of various types) as noted from both household and FGD interviews. Use of spear, gill nets and fish corral were relatively fewer.

Catch rates

Catch rates of gear types generated from household interviews varied with those from FGD. However, the general trends of catch rate among gear types for each barangay were relatively similar in both interviews. Catch rate per unit effort (CPUE) for gill net in Talibon ranged from 0.5 to 1.0 kg/fisher/hr, put in mostly by fisher-respondents from the island barangays. Gill net that targets swimming crabs had a lower range (0.2-0.4). Spearfishing with compressor had CPUE range of 0.1-0.7 that was low and fish corral and hook and line had each 0.8.

In Bongao, unlike household interviews, very few fisher respondents in FGD provided weight estimate of catch, thus only CPUE estimates generated from the former were analyzed. Most catch rate of gears in Bongao was relatively high. Line fishing had CPUE that ranged from 1.1 to 2.8 kg/fisher/hr. Estimates for jiggers ranged from 0.8 to 2.1. Gill nets had higher CPUE at 2.6-3.1. Spearfishing showed CPUE of 1.4.

Gill net CPUE estimates in both interviews in Cortes were quite similar, generally ranging from 0.3 to 0.4 kg/fisher/hr. Hook and line had 0.3-1.0 kg/fisher/hr while spearfishing (in household interviews only since there was inadequate information on the number of fishers operating each gear generated by FGD activities) was 0.3-0.8 kg/fisher/hr. CPUE was 0.6 kg/fisher/hr for fish corral and the jiggers had 0.5 kg/fisher/hr.

Culion (eastern coast) respondents in both interviews showed that CPUE for the most commonly used hook and line ranged from 0.4 to 1.1 kg/fisher/hr. Range for spearfishing was 0.6-1.2 kg/fisher/hr and gill nets generally ranged from 0.4 to 1.3 kg/fisher/hr.

Catch composition

Based on the interviews, it seems that diversity of species/taxa caught by the several gear types is not very high. This was observed in most sites. Ocular observations in fish markets and landing areas revealed a relatively high diversity of catch in Bongao only. Catch composition depends on the type of gears used. In all sites, gill nets mainly catch pelagic fish (e.g. flying fish, half-beaks, longtoms, and scombrids, among others) and some of demersal types (e.g. rabbitfish, scarids, etc.). Other variants of gill net catch a wide range of species that both include pelagics and demersals. In Talibon, many fishers use a bottom set gill net that specifically targets swimming crabs while some use drift gill nets that primarily target longtoms. In Bongao, variants of gill nets catch scombrids, and some reef associated fish such as snappers, emperors and rays.

Line fishing catch in all sites is predominantly demersals and reef associated fish (e.g. threadfin breams, snappers, big-eye scads, groupers). There are more large piscivores in the catch composition of line fishing in Bongao and Culion (e.g. jacks, emperors, groupers) compared to catch in Cortes that also comprised invertebrate feeder threadfin breams, and cephalopods. Talibon line fishing catch showed small-sized emperors and mostly goatfishes and rabbitfishes. Spearfishing catch in Bongao and Culion appeared to be similar with the presence of large piscivores such as groupers whereas these were absent in Talibon and Cortes.

Seasonality of gears

In Talibon, gill net is used year-round with high catches from December to April. This coincides with the northeast (NE) monsoon while seasonality of other gears is not very clear. Estimate mean number of days per year of use for gill net is around 110 day/yr. For crab gill net, it is 165 day/yr and spearfishing is around 100 day/yr. There appears an interesting pattern for gears in Bongao. Peak catches of the major gears (line fishing, gill net, spears) in most barangay sites are observed to occur from February to May and July-October showing a bi-modal pattern. There is higher number of days per year for most gears in Bongao, namely, hook and line (260 day/yr), gill net (248 day/yr), and spearfishing (245 day/yr). In Cortes, all gears in some barangays show peak catches from April to September corresponding to the southwest monsoon (SW). Mean annual number of days for Cortes gears (hook and line: 117; gill net: 169; spears: 158) is lower than those in Bongao but higher than Talibon gears. Gears in Culion do not seem to show seasonality and most gears are used all year round. Although number of days per year for most gears in Culion (hook and line: 179; gill net: 205; spears: 233) is higher than in both Cortes and Talibon, this is lower compared to those in Bongao.

Spatial distribution of gears

Gill nets (including bottom set gill net targeting swimming crabs) have the widest distribution in the municipal waters of Talibon. Fishers seem to use gill nets from 4 to 12 km from the mainland, encompassing waters of the island barangays and farther to more distant waters. Fish corrals appear to be clustered close to the mainland and absent in island barangays. Seaweed farming is more concentrated in Calituban and

Guindacpan extending eastward, and in San Francisco, specifically adjacent to an islet belonging to this barangay. Distribution of crab pots is limited to areas near the mainland. Among the minor gears, spearfishing seems to be used more frequently on distant fishing grounds.

Gears in Bongao are distributed within the municipal waters. Line- and spearfishing, however, are observed to occur in remote areas outside of the 15 km jurisdiction. Gear distribution for the bottom set long line is more clustered in the western part off Bongao than elsewhere in the municipal waters. Spearfishing and several types of jiggers are distributed within the lagoonal waters proximal to Bongao.

Most fishing gears in Cortes have a quite limited distribution. The top 2 gears, gill net and line fishing, however, can be observed to show wide distributions that include areas in Lanuza Bay well beyond the 15 km limit of Cortes westward. Some gears appear to be distributed in specific areas as shown by the crab lift net that were observed only in the southern portion of Cortes and that of gill net targeting flying fish of which distribution is noted in the more northerly waters of Cortes. It is also likely that more fishers use hook and line near the northern coast of Madrelino than in any fishing ground of Cortes.

Fishers in Culion seem to fish mostly in the municipal waters. FGD interviews, however, disclosed that a number of fishers travel long distances south of Culion towards Linapacan to fish in 2-3 days. Line fishing, the most preferred gear had the most widespread distribution in the eastern coast of Culion extending to about 10 km eastward and 5 km southward. Although gill net is not as widespread as line fishing, it is noted, however, that few fishers using gill net indicated fishing on the west coast of Culion. The other major gears are distributed within the municipal waters along the stretch of the east coast such as drift gill net, spearfishing and bottom set longline, among others.

Discussion

Talibon showed the highest diversity in the type of gears being used as reflected in the interviews. Other focal sites showed considerable number of gears as well although lower than those in Talibon. This is typical for artisanal fisheries such as in most municipal waters in the Philippines. An increase in the number of gears, however, suggests an increase in fishing effort. At a closer examination, the increase can be attributed to the proliferation of more efficient gears. In Talibon and Cortes, there

were more variants of gill net than other gear types used for fishing. This is exemplified by the presence of drift gill net and drive-in gill net in some barangay sites in both focal sites. It has also been noted in the interviews that beach seine is sometimes used in Talibon albeit its present ban in municipal waters in the Philippines. In line fishing, there seems to be a progression from simple handline (single hooks) to lines used with multiple hooks and, as a consequence require more fishers per unit of gear. Line fishing is observed to be more prevalent in Bongao and Culion with bottom set long line often appearing in interviews in the top gears next to simple handline. For spearing, fishers tend to use additional implements such as air compressors, perhaps for depth-dependent target species that implies fishing activities have gone to deeper areas. This is also true for traps and even for fish corrals where terms such as *bubo palalim* (fish traps for deeper areas) and *bungsod palaot* (fish corrals deployed more off-shore) are now included in the list of gear types. This indicates an expansion of modified gears to increase a wider range of target species.

The parallel conduct of both household and FGD interviews augment the fishery information especially on the difficulty of determining catch rate estimates of gears. Both methods helped to provide a better understanding on the complexities inherent to artisanal fisheries. These include key socio-economic factors. Such approach, however, should be handled by trained field enumerators as individual responses are more often than not part of the more complex information in the dynamics of the local fisheries.

Gears in Bongao have the highest catch rates among the 4 focal sites. Talibon and Cortes share the lowest with Culion having intermediate values. The information derived from the catch rates for the various gears are first approximations but these do not adequately provide the present condition of the fishery. While catch per unit effort (CPUE) is recognized as an important indicator in the fisheries, the variability in the estimates for each gear may only be better understood if other aspects of measures are known. A point in case is that of CPUE values for Talibon gears. It has been known a priori that fisher population in Talibon was the highest among the 4 sites with greatest number of gear types thus highest fishing effort. Some of its CPUE values, however, appear to be relatively higher than in Cortes. It is therefore important to get other information such as catch composition of the gear, size

composition of the catch, gear seasonalities, area of fishing, among others, to complement with CPUE values in order to elucidate the confounding factors influencing the state of the fishery.

In terms of the catch composition between gears, differences were observed from the interviews. For example, catch of gill nets appear to depend on the variations in the type (i.e. modifications made on the gear) and the depth where these are used. Surface and drift gill nets catch generally pelagic types of fish but of low value such as flying fish, half-beaks, longtoms, and scombrids, and a few tuna species while those used down the water column (mid-water and bottom set) catch demersal types such as rabbitfish, small-sized lutjanids, mojarras, scarids, and reef-associated big-eye scads as well as pelagics, scombrids mainly. These also have low commercial value. Bottom set gill net is also used to catch swimming crabs in Talibon aside from the crab pots. Unlike in Talibon, other sites largely used pots to catch crabs. This implies that there is a higher fishing effort in Talibon than in other sites. The variation may also imply a shift in catch composition due to over-exploitation. The use of line fishing is only secondary to gill nets in Talibon. This shift in the use of gears may indicate decreasing catches hence stocks of piscivores (e.g. groupers) and current fishing effort is directed at herbivores (e.g. rabbitfish) and small pelagics (e.g. scads and scombrids). This clearly suggests the effect of fishing on the trophic structure of an ecosystem (Pauly et al. 1997). In line fishing, hook and line (single and multiple) targets threadfin breams, goatfish, big-eye scads and only a few snappers, groupers and emperors in Culion but almost absent in Talibon and Cortes. These are of demersal types and highly associated with reefs. Snappers and groupers are of high commercial value especially for the latter, which are targeted in the live fish trade. Bongao and Culion are two of the major sources for the live fish trade in the Philippines. Long lines or jiggers capture cephalopods (squids, cuttlefish and octopus) but can also catch pelagic fish, while spearfishing, which is also popular in all sites, targets demersals (e.g. snappers, scarids, emperors). Fish highly associated with seagrasses (e.g., rabbitfishes) mostly comprise catch in fish corrals in most sites except for Talibon of which shrimps predominate the catch. This is another example of a change in the trophic structure due to over-fishing.

Catch rate and catch composition of gears are also largely influenced by season. Some of the emergent patterns in gear seasonality in all sites imply that some gears are used preferably for a number of months only. This is reflected in the mean total number of fishing days in a year for a gear. Bongao gears are observed to be used with the highest annual number of days since there seems to be no impact of monsoons in the area. On the other hand, Talibon gears are observed to be used with the fewest number of days per year and this may be probably influenced by the monsoons (northeasterlies and southwesterlies). Seasonality of use may also coincide with key biological processes. Fishers appear to have adequate knowledge on local spawning periodicities of some target species and fishing at spawning aggregations may bias catch rates of some gears.

Looking in the area of fishing (inferred from the spatial frequency of fishers), it can be observed that gill net and spear users are the most widespread in Talibon, with their spatial distribution appearing to be within the municipal waters that extends at the edges of the double-barrier reef complex. It should be noted however that some spearfishers tend to move a few distances beyond the barrier reef. The rest of the gears are within the municipal waters. Except for line fishers, most of the gears in Bongao are concentrated at the lagoonal waters proximal to the capital barangay (poblacion). Some line fishers have fished beyond the 15 km jurisdiction to the north. This is also true for Culion line fishers who travel as far as the southern islands of Linapacan to harvest fish. Other gears used in Culion (eastern barangays) are within the municipal waters but a few who use gill nets are found at the western part of Culion.

The extent of the gears for each focal site may depend on the status of resources such that decreasing catch in proximal areas may compel fishers to move to farther areas that they can potentially exploit. On the other hand, the type of gears used in each focal site may depend on the type of habitat and its total cover in the area. For example, the large expanse of the sandy substratum in the double barrier reef in Talibon favorably allow the use of gill nets such that the top gear in this focal site is gill net and most of the catch are swimming crabs, goatfishes and scombrids. In Bongao and Culion, line fishing is the dominant gear because there is more cover of reef substrata in these 2 focal sites compared either to Talibon or Cortes.

Summary and recommendations

State of fisheries

Bongao have relatively the highest catch rates (CPUE) of most gears used followed by Culion then by Cortes and Talibon. In the catch composition, Bongao still reveal presence of many large piscivores (e.g. groupers) that is also observed in Culion but to a lesser degree. These key functional groups are almost absent in Cortes and Talibon as fishers shifted to other types of gear. All sites, however, show expansion of fishing areas with fishing activities at a few kilometers to several kilometers away from the coast. This is also complemented with an increase in number of modified gears and fishers in all sites. Based on these findings, it appears that while Bongao is under moderate exploitation the rest show high exploitation levels. Moreover, fisheries dynamics or fish stocks almost never stabilize as these are impacted by natural perturbations as well (e.g. El Niño phenomenon). Given the present rate of extraction and condition of the 4 focal sites, the projections for fisheries in the Philippines are alarming.

Importance of interviews and FGDs in understanding the state of fishery

Results of interviews may not be derived through systematic and straightforward as science-based fishery independent protocol is but these are nonetheless reliable because they provide other useful insights not readily observed in the fisheries. Participatory approaches allow the emergence of some people-based information such as historical perspectives on fishing gears and their catch rates. In the absence of hard data on previous fisheries profiles of major fishing areas, information such as trendline of catch based upon knowledge on past and present gears are crucial in understanding the state of the fishery. It provides some knowledge on the baseline information of the fishery and the processes related to its development. These are key to the assessment of the fisheries and establishment of management options. Interviews are relatively faster and cheaper but should also follow the rigor of data collection in order to get better precision of indicators in the fishery. In the present study, it has been noted that in order to determine the state of the fishery of a focal site, it depends largely on the selection of barangay sites. Interviews should be

carried out in barangays with large proportions of fishers relative to the focal site. In the case of Talibon for example, interview was more intensive in the island barangays of Calituban and Guindacpan due to higher fisher populations in these barangays compared to other barangays. Selected barangays should also represent important fisheries in the focal site like for example the live fish collectors in Culion and in the greater area of Calamianes Islands. In this manner, the design permits a stratified sampling in each barangay site and thus a better representation of the fishery of a focal site.

Next steps

Interviews (one-on-one household interview and FGD) provide insightful aspects of an artisanal fishery (e.g. key socio-economic information) not emergent in the standard fishery-independent and -dependent survey protocols. Interviews should therefore complement routine fisheries assessment techniques. To determine benchmark indicators for the project performance, it is recommended that fishery-dependent assessment through interviews should be considered. This is viewed as an enabling input for some identified benchmark indicator, like for example, CPUE derived from fishery-independent activity. Interview-derived information such as popular gears, their catch composition, use seasonality, catch trendlines, and other socio-economic issues mediated by the fishery, etc., are complementary to parameters that will be derived from fishery-independent and –dependent assessments. These also include other indicators such as density of fishes in marine protected areas (MPA) on a chosen scale, and habitat condition (e.g. coral cover). Adaptive management will track the changes through time in any of these indicators. For example, this study was able to provide an initial description of the catch composition of gears in the focal areas. Determining size composition of a selected model species from the catch composition may provide a better handle for the enabling inputs to the project results. Catch trendlines and issues related to CRM and FRM derived from FGDs will not only serve as avenues for determining management options but to allow fishers to become aware of the issues and get actively involved in the management.

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3.4.5 Determination of sample sizes for various experimental fishing designs in Talibon, Bohol and Culion, Palawan

Introduction

One of the important tasks for the Baseline Assessment team of the FISH Project is to determine suitable field-based sampling procedures to reliably detect changes in fish biomass over discrete periods of time to test effects of management efforts. This is important to make future adjustments in the choice of management strategies to apply on specific areas. Thus, the reliable detection of changes in fish biomass over time is important to fine tune management efforts as well as for the main goals of the FISH Project. To achieve this purpose, a properly designed experiment must ensure that power is reasonably high to detect reasonable departures from the null hypothesis (i.e. $\bar{x}_1 = \bar{x}_2, \dots = \bar{x}_n$) otherwise, the test is hardly worth doing. Two of the most important factors influencing power in a statistical test are the kind of statistical test being performed and the size of samples (number of replicates).

The kind of statistical test matters because some tests are inherently more powerful and robust than others. Similarly, sample size is important because the larger the sample size, the larger the power. However, in many cases, increasing sample sizes involves increases in costs. Hence, it is important to decide a sample size large enough to detect reasonable differences but not wastefully large.

The main objective of this section is to provide a suitable range of sample sizes to reliably detect differences in fish biomass at small and large levels of change over time for each of the four experimental designs in test fishing. This section has two specific objectives. The first is to determine a range of reasonable statistical power to reliably detect changes between baseline levels of fish biomass and that after a discrete period of implementing management interventions. The second is to determine the sample size necessary to achieve a level of power that can reliably detect changes in fish biomass over time.

Methodology

The designs of the fishing experiments conducted at Talibon, Bohol and Culion, Palawan were subjected to a power analysis using Statistica Ver. 6 (Statsoft, Inc. 2001) to address the objectives above. The experimental designs were tested under two categories of effects. The two levels were the small and large changes, which corresponded to a Root Mean Square Standardized Effect (RMMSE) of 0.25 and 0.50, respectively (sensu Cohen 1983). RMMSE is a measure of the size of standardized effects in an experimental design. The power analysis module of Statistica Ver. 6 (Statsoft, Inc. 2001) was used in the determination of statistical power and range of suitable sample sizes to detect reasonable changes in fish biomass for each of the four designs.

Results and Discussion

Except for the experimental design to determine biomass of soft bottom fish using beach seines in Talibon, Bohol, the statistical power of the three other designs was relatively good (0.67 to 0.74, see Table 1), although increasing slightly sample size (additional 5 to 10 replicates) can improve power from 0.83 to 0.90 levels (see Figures 2-4). The poor statistical power of the design for the determination of

biomass of soft bottom fish using beach seines (0.08) in Talibon, Bohol was largely due to the smallness of sample size used ($n=2$, see Table 1). Clearly, a sample size of 2 replicates does not have sufficient statistical power to detect reasonable changes in biomass of soft bottom fish stocks in Talibon, Bohol, whereas sample sizes in excess of 10 provide better statistical power but still below a usual target goal of 0.90.

An analysis of the experimental design showed that at least a sample size of 20 is required to increase the statistical power of the beach seine experiment from 0.08 to 0.79 to reliably detect large changes in biomass of soft bottom fish stocks in Talibon, Bohol (Figure 1). Consequently, to detect smaller changes in fish biomass for the beach seine experiments in Talibon, Bohol it will take four times more replicates ($n=80$) to achieve the same statistical power as that to detect large changes (Figure 1).

In the case for crab pots (panggal), the experimental design showed a statistical power of 0.74 (Table 1) to detect large differences in crab biomass in Talibon, Bohol. However, if sample size is increased from 10 to 15 replicates, statistical power of the same design improves to 0.92 (Figure 2). However, if one is interested in reliably detecting smaller and finer changes in crab biomass over time, it will require 3.6 times more replicates ($n=55$) to achieve the same statistical power as that to detect larger changes (Figure 2).

The statistical power of the two experimental designs to test changes in fish biomass of demersal (using bottom set long line) and pelagic fish stocks (using simple handlines) in Culion, Palawan was relatively good (0.67 and 0.69, respectively, see Table 1) to detect large changes over time. These statistical powers were obtained with a sample size of 24 and 25 for bottom set long line (BSLL) and simple handlines (SHL), respectively. If the number of replicates was increased from 25 to 30 for both designs, the statistical power improves to about 0.77 (Figures 3 and 4 for BSLL and SHL, respectively) in detecting large changes. However, if smaller changes are of interest, then it will require 118 replicates for both designs (Figure 3 and 4) to achieve the same statistical power as that to detect larger changes.

The range of sample sizes at varying levels of power goals for the four different experimental designs is presented in Table 2. Note that to achieve a statistical power of at least 0.80, sample size must at least be 33 for test fishing using bottom set long line and simple handlines in Culion, Palawan, and 12 and 21 for crab pots and beach seines, respectively, for Talibon, Bohol to be able to detect large differences in fish biomass. To detect smaller differences of fish biomass at the same level of statistical power will require at least 3 times the number of replicates required to detect large differences for all four experimental designs.

A statistical power of 0.80 is acceptable but many research workers target a power of 0.90 or better. In the case of the experimental fishing to test biomass of crabs using crab pots, a reasonable increase of 5 replicates to the existing design will provide a statistical power of 0.92 to reliably detect large changes. Statistical power of this level is also achievable for the three other experimental designs but at sample sizes 2 to 3 times that of the crab pot experiment. Thus, given all the constraints for the various experimental fishing, sample sizes between 25 and 30 are going to provide the best statistical power to reliably detect large differences in fish biomass over time in Talibon, Bohol and Culion, Palawan. Increasing the current sample size to between

25 and 30 replicates may mean an additional 2 days of fieldwork at worst. The benefits of increasing sample sizes of the experiment far outweigh the additional costs in time and money.

Recommendations

- Experimental fishing independent of the fisheries should be pursued in all four sites and the results considered as the primary indicator of determining status of fisheries resources over time. Based on the baseline assessment of the fisheries, the two gears common and prevalently used in all 4 sites are gill net and hook and line. These two gears can be used in test fishing for all sites.
- Based on the foregoing power analyses of the designs of various test fishing (fisheries independent methods), the FISH contractor must consider the following cases:
 - For designs that will consider changes between 2 groups in a 1-way ANOVA (e.g. Year 1 vs. Year 3) a minimum sample size of 33 is needed to achieve statistical power of around 0.80. This level of replication can reliably detect large changes in fish biomass between two discrete periods of time after management strategies are initiated.
 - For designs that will consider changes between 3 groups in a 1-way ANOVA (e.g. Year 1 vs. Year 3 vs. Year 5) a sample size of 25 is needed to achieve a statistical power of nearly 0.90.
 - If newer sites are established then this will just be treated as additional samples in the design. If the question is to examine changes within and between 2 factors (for example spatial and temporal), then we deal with a 2-way ANOVA design. Under a 2-way (3x3) ANOVA design, a sample size of 15 to 20 is most suitable to achieve statistical power of between 0.88 and 0.96. A sample size of 13 will provide a statistical power of 0.80 under the same design.
- Fish contractor must also consider catch composition and size structure in addition to monitoring of catch per unit effort (CPUE) to provide more biological meaning to the proposed Project indicators. Studies have shown that CPUE can improve as a result of species replacement in catches. Moreover, CPUE can also improve with more but smaller fish in catch.

Species replacement and shifts to smaller size classes of catch are clear indicators of overfishing.

- The same independent Baseline Team must revisit the sites to conduct the same tests to determine progress in the status of fish stocks halfway through the project. This will provide an independent measure of the various indicators of the project at the same sites. The effort of the independent Baseline Team can be combined with the monitoring efforts of the FISH contractor to increase statistical power of tests. Since this has not been done during this period due to the constraints of the FISH contractor, it should be considered in the next sampling.
- While CPUE obtained from fisheries independent methods is considered as a primary indicator for the status of fish resources, the use of fish density expressed as biomass per unit area of habitat should also be considered. Using swept area methods for the soft bottom area are desired (e.g. the “baling” beach seine) and should be undertaken in all the sites where feasible. Alternatively, if swept area method is not feasible, other sampling methods must be tried such as those tried during the baseline assessment. However, this will entail the determination of effective fished areas (EFA) for fishing gears that target the midwater pelagic fish (e.g. for hook and line) and the soft bottom demersal fish (e.g. bottom set longline). The determination of the EFA may be addressed during the duration of the project via targeted research using graduate students.

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Table 1. Power of analyses of the current designs of experimental fishing conducted by the Baseline Assessment Team for the FISH Project to detect fairly large changes between groups (i.e. Root Mean Square Standardized Effect or a measure of the size of standardized effects in the design is large (RMSSE=0.5)) using Statistica Ver. 6.0 (Statsoft 2001).

Gear	Localname	Location	Target Stocks	No. of Groups	Sample Size	Power of Analysis	Remarks
Crab pot	Panggal	Talibon, Bohol	Swimming crabs (rel. sedentary)	6	10	0.74	A sample is a string of 15 traps
Beach seine	Baling	Talibon, Bohol	Soft bottom fish (demersal)	2-3	2	0.08	A sample is a single drive
Bottom set long line	Kitang	Culion, Palawan	Threadfin breams (demersal)	2-3	24	0.67	A sample is a string of 1000 hooks
Simple handline	Kawil	Culion, Palawan	Round scads (pelagic)	2-3	25	0.69	A sample is a about 12 hr fishing effort

Table 2. Summary of the number of replicates required for varying power goals for the current designs of the different experimental fishing to detect large changes in fish biomass under the FISH Baseline Project.

Gear	Localname	Location	Target Stocks	Power Goals			
				0.65	0.70	0.80	0.90
Crab pot	Panggal	Talibon, Bohol	Swimming crabs (rel. sedentary)	9	10	12	15
Beach seine	Baling	Talibon, Bohol	Soft bottom fish (demersal)	15	17	21	27
Bottom set long line	Kitang	Culion, Palawan	Threadfin breams (demersal)	23	26	33	44
Simple handline	Kawil	Culion, Palawan	Round scads (pelagic)	23	26	33	44

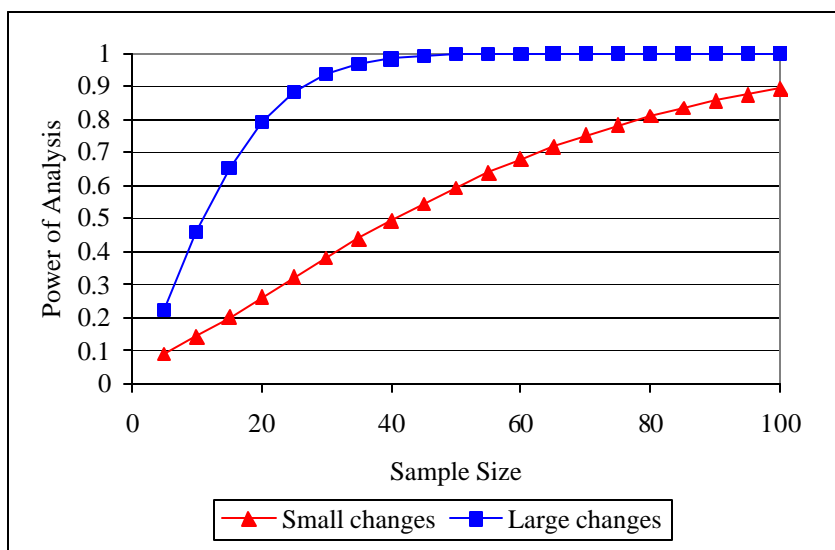


Figure 1. The relationship between number of replicates (sample size) and the power of analysis for experimental fishing using beach seine in Talibon, Bohol to detect small and large changes. The power of the current sample size is insufficient and needs to be increased from 2 to at least 15 to increase power from 0.08 to 0.65 to detect large changes between groups.

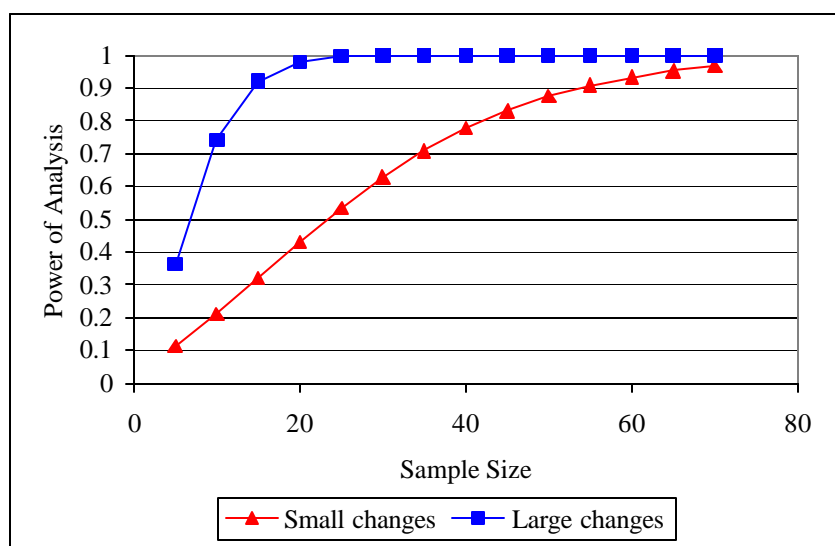


Figure 2. The relationship between number of replicates (sample size) and the power of analysis for experimental fishing using crab pots in Talibon, Bohol to detect small and large changes. Note that more replicates are required to detect significant small than large changes between groups. Adding 5 more replicates to the current replicates will bring the power of the design from 0.74 to 0.92 for detecting large changes.

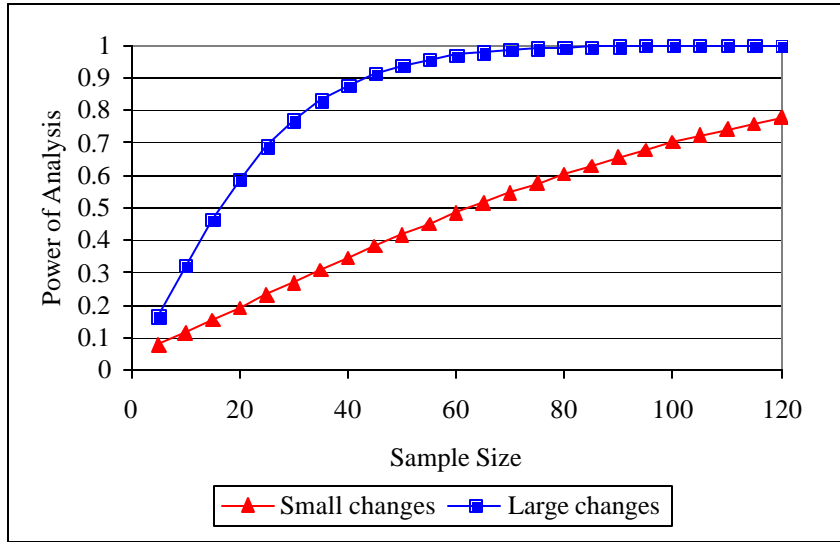


Figure 3. The relationship between number of replicates (sample size) and the power of analysis for experimental fishing using bottom set long line in Culiion, Palawan to detect small and large changes. The power of the current sample size to detect large changes can be improved from 0.67 to 0.77 if sample size is increased from 24 to 30. To detect small changes at the same level of statistical power, the design requires 118 replicates.

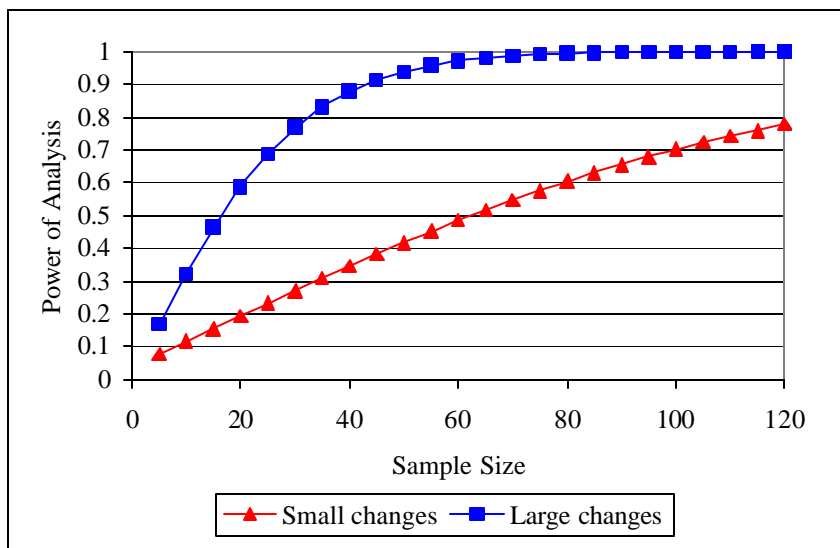


Figure 4. The relationship between number of replicates (sample size) and the power of analysis for experimental fishing using simple hand lines in Culiion, Palawan to detect small and large changes. The power of the current sample size to detect large changes can be improved from 0.69 to 0.77 if sample size is increased from 25 to 30. To detect small changes at the same level of statistical power, the design requires 118 replicates.

3.4.6 Using integrative framework models in understanding fisheries ecosystems

Recent reviews in fisheries ecosystem management have shown that Marine Protected Areas (MPAs) are inherent and necessary intervention in fisheries and coastal management albeit not all encompassing (Browman et al. 2004). Thus, recent models tend to consider spatially explicit concerns in the interaction of fishing effort and MPA management and other fisheries decision options (e.g. market dynamics as affecting prices and other social consequences of actions or inaction). We utilize a Stella based modeling engine to simulate scenarios based on the FISH BE model (Licuanan et al., 2004 in press, Fig. 1). Based on a series of scenarios of catch rates and fisher population and species interaction scenarios, the size of MPAs that are derived seem to be consistent with increasing level of fishing and there is an increasing need for a larger size of MPA Table 1.

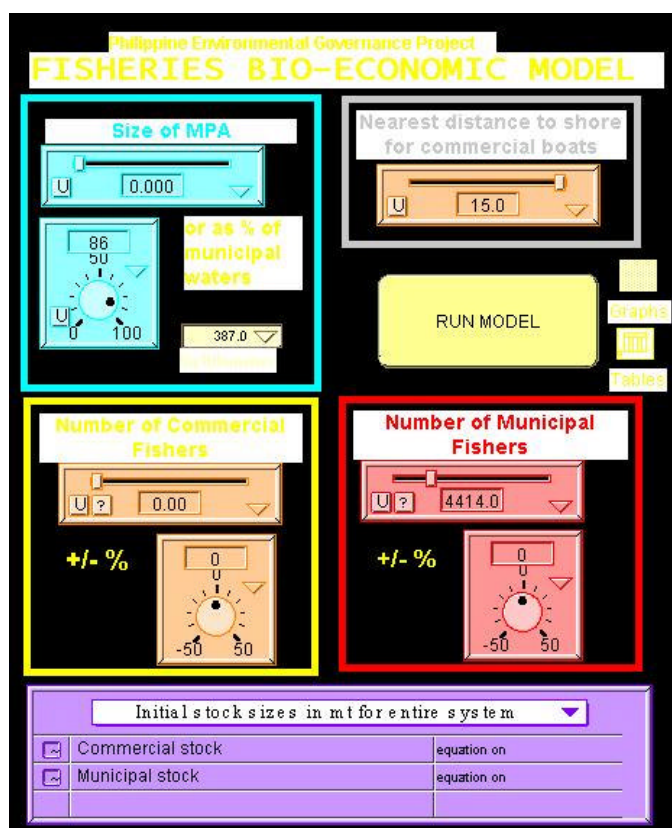


Figure 1. Stella based modeling engine used in the Fisheries Bio-economic model

Table 1. Scenario defined results on the percentage area allotment for MPA on the four focal sites

Focus Sites Samples	Scenario	Remarks and Insights
Talibon	3000-4415 fishers; 0.021- 0.024 tons/km ² per year	18-86% of the area as MPA
Surigao	1500 fishers; 0.01 tons/km ² per year	20% of the fishing area as MPA
Culion	810 fishers; 0.017 tons/km ² per year	11% of the fishing area as MPA
Bongao	~0.009tons/km ² per year (derived from a fishing area of 1000 sq km) with 1500 fishers	11% of the fishing area as MPA

This seems to be concordant with the intuitive logic suggested by many investigators (e.g. Russ 2002 and Campos et al. 2004, in press). But what is more interesting is that dependent on the area of operation and the degree on the composition of the fish caught

in the area (i.e. demersal versus pelagic), the types of interventions and its effects are not as easily predictable. This suggests that efforts at integrating various indicators that are derived from various inputs and processes, which move in non-linear trajectories should be viewed at various perspectives and context. It is apparent that it is very important to be clear on what ecological scale is being detected by an indicator in response to a particular fishery management intervention. To clarify these various representations of the fisheries management phenomenon, one can use various conceptual framework diagrams similar to the flow diagrams in FISH (FISH BAP, April 2004) or other visualization techniques and analytical tools. Based on our utilization of simulation models, it has been useful to clarify and investigate “what if” scenarios using different assessment data and derive a knowledge base of information to base some of our assessment designs (e.g. FGD questions to be asked) and approaches (e.g. priority information that are useful to gauge fishing pressure, the types of interventions at various spatial and temporal scales). In this way, the baseline assessment process is not only a mechanistic process. It also derives heuristic values gaining further knowledge base and learning experience, both at the specific intervention and site-specific features. Furthermore, its context vis-à-vis its contribution to a larger body of knowledge base help in the design and setup of databases and decision support for projects.

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3.4.7 Summary and Recommendations

This section summarizes the main results and insights derived from the baseline assessment characterization of the focal sites as pilot sites in the target areas of the FISH project. These lessons are considered in relation to its relevance to providing accuracy in the baseline assessment of the status of the sites and how these procedures are crucial to the subsequent monitoring and evaluation. In addition, it is hoped that these insights and recommendations help enrich the theory and practice of ecosystem based adaptive management. In this way perhaps the challenge of sustaining fisheries stocks could be seriously addressed with sufficient resource allocations, strategic and timely interventions.

1. **Enhance FISH framework with an integrated model**, include Oceanography characterization and consider including other associated habitats as to relevance in the fisheries ecosystem management regime.

Much of the baseline assessment has been based on our experience and the development of our perspective of what is the fisheries ecosystem management framework, its objectives and its desired outcome. The FISH project framework can be further enriched, if some integrated ecosystem models are utilized to further understand the specific and context utility of the various fisheries indicators. These models can help in the design and adaptive management strategies to be considered in the process of various decision-making scenarios.

2. **Choose appropriate fisheries independent techniques for each site** and assist the design of sampling based on the hypothesis generating approaches and inferential analyses.

Sampling and its experimental design in the subsequent years is to represent the reality of what is the desired outcome of 10% fisheries increase. This outcome can best be characterized by fisheries independent technique [PR1], such as the experimental fishing designs and fish visual census [PR 3] in the coral reef area made in Talibon, Bohol and Culion, Palawan. Information specific to sites can be complemented with other information (e.g. size and composition of fisheries).

3. **Utilize a “triangulation” approach in viewing catch rates from fish landings** and other insights from FGDs to derive spatially explicit fisheries characteristics

“Triangulation” in this context refers to the process of understanding and responding to the learning from the assessment and monitoring of fisheries in major fish landing sites. This Catch rate, referred to as Catch per Unit Effort (CPUE), is useful in understanding the fisheries in an area, especially if they are used in tandem with spatially explicit fishing activity. This is seen for example in areas where they catch the gravid fish or the fry areas or feeding ground observations. In addition, other related features could be considered as intermediate or enabling indicators. Use the complementation and connectivity of habitats to stratify habitat-based indicators to fully complement and integrate other habitat indicator specific responses into an overall ecosystem based fishery management regime (e.g. reef associated fisheries, soft bottom fisheries, mangrove grouper, mud crabs and shrimps).

4. **Analyze multivariate and multidimensional correlations** of coral reef fish [PR3-PR4] and benthos [PR5] to discriminate natural and human induced effects

Spatio-temporal variability of natural and social ecosystems is multidimensional. Thus, it would require investigations to explain the effects of natural phenomenon whether they exacerbate or dampen management intervention effects. These insights also link to the next item of concern to harmonize and find synergy in biodiversity conservation and fisheries management. As discussed in the coral reef integration section, it is apparent that these three indicators’ [PR3- 5] features are critically important in conjunction with size class distribution analyses.

5. Pursue biodiversity conservation and stock enhancement fisheries management complementation through **targeting a minimum no-take area of 10% of coral reef in the focus sites**

These complementary objectives are important to note in order to view the enabling nature of indicators PR 3-5. It is critical to note that some areas, like Talibon and Cortes, have shown size class reduction of target species perhaps reduced to over 30-50% of the inferred size class of their size at sexual maturity. Thus the importance of MPAs of a sufficiently considerable size (e.g., at least 30% of the total reef area) is crucial in supporting and providing the protection of spawning stock biomass through overall habitat protection of an area of sufficient size, for recovery and enhancement of fisheries stocks (e.g. sea ranching).

Integration Workshop and Proposed Baseline Indicators

Appendix D-2 is the minutes of the integration workshop for the validation and baseline assessment results and discussion of the baseline indicators. Despite only a preliminary presentation of the results of the available baseline assessments in Talibon, Bohol and Carascal, Surigao results of the contractor's baseline assessment, was in general agreement with results of the independent baseline assessment. However whether this will be borne out by further analyses when the contractor's assessment is complete, remains to be seen.

4.1 Substantive considerations in the baseline assessment and the objectives of the Independent Baseline Assessment and benchmark indicators

The substantive considerations discussed during the baseline assessment integration workshop were on:

4.1.1 The criteria of the choice for subsequent focal areas

The baseline teams propose that given more information and a better understanding of the target area after the baseline assessments, subsequent expansion to other focal should consider the potential importance of the area to contribute towards a 10% increase in fish stocks in the target area. Some of the important considerations to give priority to are: the ecological value of the sites, such as the extent of the habitats and the degree of fishing activity and population density of fisheries resource users.

4.1.2 The scale of the management unit in the focal area within the target sites

The baseline team proposes that the contractor look at the appropriate scale of sampling taking into consideration total area of specific habitats within the respective municipal waters of each focal area. For example this would refer to the soft bottom area sampled in the fishery independent sampling as suggested by the independent sampling to detect a change of 10% from baseline (see Sec.3.4.5). For the coral reef area, this would refer to 10% of the MPA that is representative of the coral reef area found within the focal areas municipal waters. It means that the size of the management area should be a meaningfully representative (e.g. based on an ecological and resource management unit linkage) of a focal area at each target site. Thus, consideration should be made to clarify what the 10% increase of fish stocks represents. Albeit it should at least approximate the area that is being impacted, based on its resource users and their relation to the ecological unit being managed and the type of intervention employed.

4.1.3 How to gauge the 10% increase from baseline

The baseline team proposed that each indicator should be viewed in their specific contexts, and not averaged within and between sites. The indicators are indicative of

varying context of indicating the achievement of the objective of the 10% increase in fish stocks. The primary baseline indicators should be [PR1] and [PR3] and the remaining [PR2, PR4 and PR5] as enabling indicators.

Given the previous point, it follows that it is not appropriate to average the indicators in a focal area and across focal areas. Instead it is proposed that the specific indicators and the other enabling indicators (to describe and understand the changes that occur in each site) at each site be viewed separately. A pooling of the samples of the scores of each sampling technique and their average per indicator can be made. This will be the basis for achieving 10% at each target site. The PFPP will be based on equal proportions that have achieved a 10% increase in the target site (see also discussion on meta-analyses).

4.2 Agreements, Recommendations and Next steps

The baseline assessment phase of the FISH project is just the crucial first steps in evaluating the progress and further adjustments that might be necessary. There was general agreement that the process of engaging an independent baseline assessment contractor provided value-added insights to the project.

Despite some variance in opinion in some minor areas there was general agreement in the basic principles on the substantive concerns.

Whereas, serious consideration of the baseline contractor's proposition on the criteria for the next sites will be made, the FISH contractor in close consultation with USAID will have to discuss these concerns. These concerns refer to the utilization of strategic criteria for choice of focal areas (e.g., ecological significance and strategic importance of the area in relation to fisheries management such as the number of resource users) and decide on the operational feasibility of the choice of the next sites.

Whereas, general agreement was made on the scale of the sampling protocols, it is important to level off and clarify with USAID their expectations on the degree of how these focal areas are representative of the 10% target of increasing fish stocks.

Whereas, general agreement was achieved on the baseline indicators, the details of the how these are going to be viewed in relation to the PMP and its link to the PFPP are going to be discussed separately with the baseline contractor's PMP and PFPP specialist.

It is recommended that the separate discussions with the contractor and USAID consider the abovementioned proposals in this section and the other sections (e.g. Sec. 5 for the PMP and the PFPP). The next section discusses in greater detail the findings of the all the preceding sections and their implications to the subsequent monitoring and evaluation periods and their significance to the PFPP.

Performance Monitoring Plan (PMP) and Performance Fee Payment Plan (PFPP)

One of the tasks of the baseline contractor is to “*review the proposed PMP and PFPP of the FISH contractor... and prepare a report describing their evaluation of and recommendations on the said documents in the light of the baseline findings*”. This section discusses the results of our evaluation of the latest draft PMP prepared, and provided to the baseline contractor, by the FISH contractor. The review results are presented in accordance with the major sections of the draft PMP, which includes (i) an introduction; (ii) results framework; (iii) methodology; (iv) data analysis and management; and (v) performance indicator reporting.

As of the time this report was written, the PFPP outlined in the FISH contractor’s original technical proposal to USAID had not yet been updated. Said fee payment plan was based on a draft results framework, and had proposed a results delivery schedule, with corresponding fee payments to be made during Years 6 and 7 of project implementation. The FISH contractor plans to develop the PFPP based on the outcome of the USAID review of the draft PMP, which the FISH contractor will submit to USAID by the end of August 2004. At the earliest, a final proposed PFPP could be expected after the FISH contractor’s completion of its on-going baseline assessment, approximately by the end of October 2004¹. More realistically, a “firm” PFPP could be expected to be formulated after the first “special monitoring event” scheduled in 2006 (Year 3) – using actual field lessons and experience as basis for developing the fee payment plan. Having only the FISH contractor’s original PFPP, the baseline contractor does not have much to review and evaluate at this time. In any case, a few notes on the how the evolution of the PFPP might be guided will be made at the end of this section.

The draft PMP already provides a good basis for performance monitoring. The comments and recommendations regarding the draft PMP and PFPP, as contained in this section, are intended to further strengthen the plan. These comments and recommendations were formulated mainly from a performance monitoring specialist’s, rather than a fishery scientist’s, perspective, but within the overall analytical framework adopted by the baseline contractor.

Results Framework

The PMP framework discusses the overall FISH Project Result (FPR), three intermediate results, corresponding biophysical and institutional indicators, units of measure, and targets.² The results are presented under the strategic objective of “*productive and life*

¹ The target of October 2004 is based on consultations with the FISH contractor, and the timetable in Tetra Tech EM Inc., “Baseline Assessment Plan” (FISH Document No. 06-FISH/2004), Version Draft Final, April 2004, pages 21-22 & 25.

² An “indicator” may be defined as a unit of measurement that facilitates comprehensive, concise and balanced judgments about a situation. “Indicators” are measured through relevant data collected for each

sustaining natural resources protected through improved management and enforcement”.

Five “project result” (PR) or “primary” indicators are proposed to be used to measure achievement of the overall FISH Project Result of “*marine fish stocks increased by 10% (over 2004 baseline levels) in focal areas by the year 2010*”. These are PR1: abundance of selected fisheries resources in focal areas (% change in CPUE compared to baseline based on fishery-independent methods); PR2: catch rate of selected fisheries in focal areas (average % change in CPUE compared to baseline based on fishery-dependent methods); PR3: reef fish density inside and adjacent to selected MPAs in focal areas (% change in abundance/500 square meters compared to baseline); PR4: reef fish species richness inside and adjacent to selected MPAs in focal areas (% increase in number of species/500 square meters compared to baseline); and PR5: benthic condition inside and adjacent to selected MPAs in focal areas (% change of living coral cover compared to baseline). Except for PR4, these are the same PRs previously identified in the FISH contractor’s Baseline Assessment Plan.³

Various “intermediate result” (IR) indicators are provided in support of the primary indicators, and corresponding to each of the three intermediate results. There are seven, one and two institutional indicators, respectively, for the following intermediate results: (1) national and local capacity increased for fisheries management in four target areas; (2) national policy framework developed supporting sustainable fisheries; and (3) constituency of informed, disciplined and cooperative stakeholders developed and engaged in fisheries management.

The above PR and IR indicators could be evaluated in terms of three main criteria (a) comprehensiveness; (b) degree of finality; and (c) primacy.

1. **Comprehensiveness** – The performance monitoring system should capture all the major concerns of the FISH Project, as articulated in the project objective, strategy and components. How can we ensure that no “primary indicator” is left out? One way to do this is by using a “sustainability model” adapted from the “pressure-state-response (PSR) framework” developed by the World Resources Institute.⁴ “Pressure indicators” cover human activities that affect the state of natural resources, which in turn are represented by “state indicators”. (From a market economics perspective, pressure indicators could be regarded as the “demand side indicators”, while state indicators would be the “supply side indicators”.) “Response indicators” are the policies, programs and projects developed to address the undesirable consequences of

one. “Performance” on the other hand is measured by comparing accomplishments versus “targets”, which are explicit statements of desired results at specific points in time.

³ Baseline Assessment Plan, page 11.

⁴ NEDA, DENR & UNDP, A Sourcebook of Sustainable Development Indicators, 1998, pages 12-13.

human activities on the state of natural resources. The sustainability model complements the Fishery Ecosystem Management (FEM) approach presented by the baseline contractor.⁵

Figure 1 below suggests that the Performance Monitoring Plan's intent of measuring project performance through five primary indicators and a total of ten intermediate indicators may not be sufficient to capture all the major concerns of the FISH Project, because there are other pressure and response indicators that should be given emphasis in order to guide the project towards achieving its main objective. Four additional intermediate result indicators are suggested: (a) "sustainable tonnage" harvested from the focal areas by both municipal and commercial fishers (recognizing that the activities of commercial fishers strongly affect conditions in municipal waters, e.g., Navotas trawlers operating in Culion)⁶; (b) percent reduction in fishing intensity, linked to an estimate of the maximum sustainable yield (MSY) from the focal areas; (c) percent reduction in illegal fishing activities; and (d) percent of community members effectively participating in control and growth responses, as the key indicator of the "breadth of participation" and sustainability-determining behavioral changes that shape fishing intensity and practices. It would also be desirable to adopt "quality" and "depth" of participation by the communities (e.g., gender-disaggregated trends in attendance; percent of invitees who actually attend related forums; percent of women attendees who actually participate in discussions; etc.) as a key process indicator. A "key process indicator" could also be referred to as an "enabling indicator" – defined to be a measure of progress towards desired intermediate results. For example, enforcement of fishing regulations could be used as a process indicator leading towards a reduction in fishing intensity. As another example, effective participation leads to – or is a key ingredient in – sustained local monitoring and regulation of commercial fishing in municipal waters.

⁵ DAI/MERF, "Review of the FISH Baseline Assessment Methods", page 1.

⁶ Monitoring of commercial harvest from municipal waters will not be easy, and will require persistent implementation of an innovative community-based resource use monitoring system.

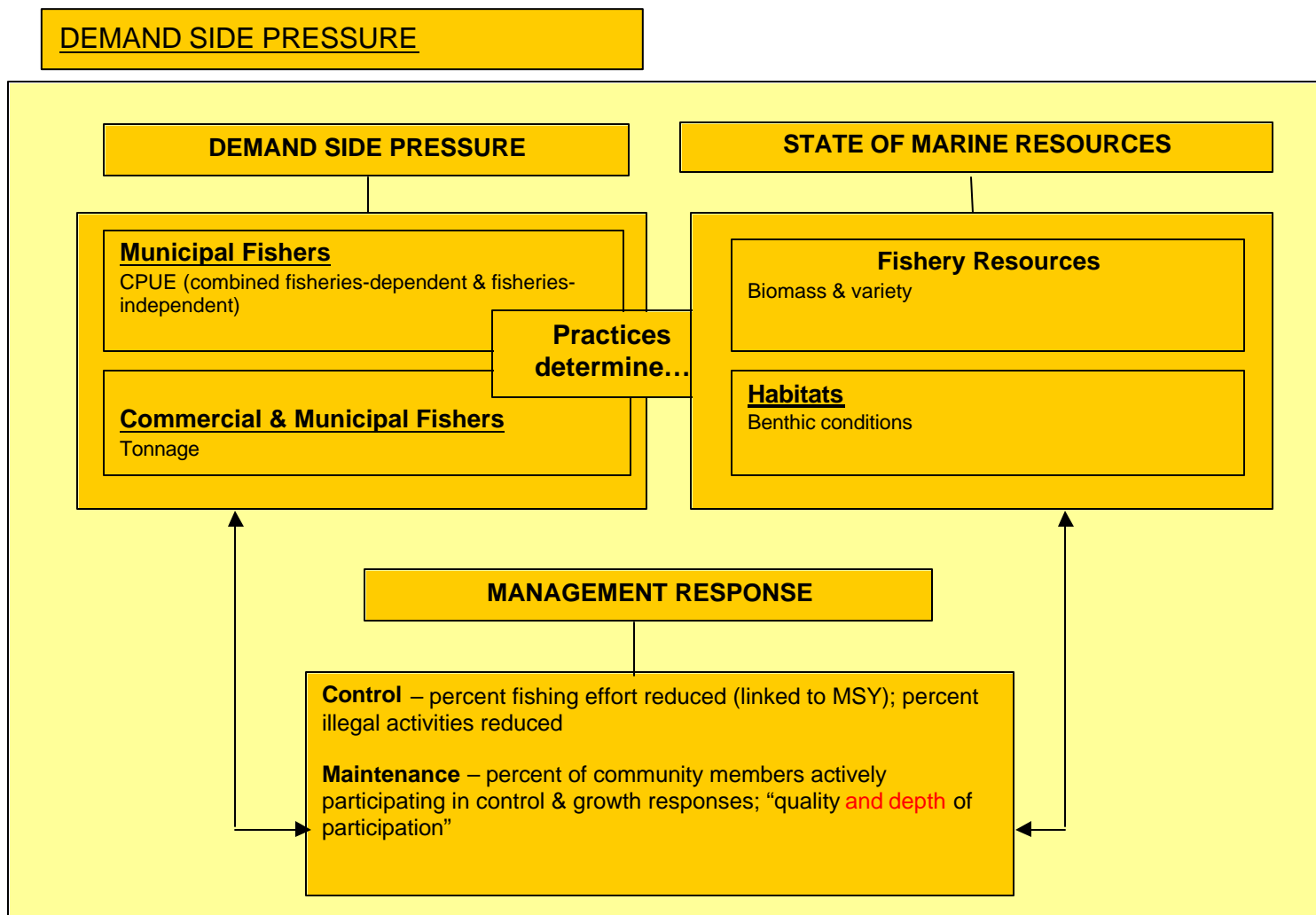


Figure 1. Suggested Performance Indicators based on an Adaptation of the Pressure-State-Response Model

The above-suggested four additional intermediate result indicators, plus the key process indicator, could be classified as follows:

Results	Intermediate Indicators	Process/Enabling Indicators
<i>Intermediate Result 1</i> : National and local capacity increased for fisheries management in four target areas	“Sustainable tonnage” harvested from focal areas by both municipal and commercial fishers	Quality and depth of participation of local communities
<i>Intermediate Result 2</i> : National policy framework developed supporting sustainable fisheries	Percent reduction in illegal fishing activities Percent reduction in fishing intensity	
<i>Intermediate Result 3</i> : Constituency of informed, disciplined, and cooperative stakeholders developed and engaged in fisheries management	Percent of community members effectively participating in control and growth responses	

2. ***Degree of Finality*** – What are the “intermediate result indicators” for achieving the project objective? Each of the said indicators should have a direct and strong relationship to the “final outcomes” being measured, and could be examined in terms of an input-output relationship. For example, “number of coastal law enforcement units established and/or improved and functional in each target area” (IR1.2) is not suggested as an intermediate result indicator because it is a project input expected to lead to a “reduction in illegal activities”.⁷ Going down the list of other proposed intermediate result indicators included in the FISH contractor’s results framework, neither are “number of effort restrictions introduced” (IR1.3), “number of public-private partnerships” (IR3.1) and “number of information materials distributed and trainings/forums conducted” (IR3.2) desirable intermediate result indicators, because these are inputs contributing to a sustainable “reduction in fishing intensity” among other results. The “number of agreements/plans signed or adopted among relevant stakeholders” (IR1.6) is a project input leading to a sustainable increase in CPUE (among others) as the desired result. Each of the rest of the intermediate indicators could be similarly screened, as done above, to test its degree of finality vis-à-vis

⁷ Objectively verifiable measures to determine “improved and functional” law enforcement units need to be identified.

expected final outcomes. Inputs (e.g., law enforcement units established; number of effort restrictions; number of public-private partnerships; number of information materials distributed; and trainings conducted) could instead be regarded as “key process indicators” leading to desired intermediate results.

Project managers will monitor both the results and key process indicators, but performance reports and analyses would focus on the results indicators in order not to clutter management options under a results-based management regime, and thereby more effectively communicate the “major messages” to project decision-makers.

3. **Primacy** – The draft Performance Monitoring Plan proposes that various primary and intermediate result indicators be monitored in order to determine achievement of a 10% increase in marine fish stocks in focal areas by Year 2010. The preceding discussions suggest a way to “prioritize” the various indicators in terms of proximity of relationship to the desired final outcomes: some of the indicators will thus be considered “primary result”; others are “intermediate result”; and the rest as “key process” or “enabling”. Given the significant number of proposed indicators, however (including the suggested four additional intermediate result indicators), which indicator should have “primacy”? The answer would depend on which one is deemed to have the closest relationship to – or be the best reflection of – the overall project result (FPR) of increasing marine fish stocks by 10%. *In this regard, PR1: abundance of selected fisheries resources in focal areas (% change in CPUE compared to baseline based on fishery-independent methods) is recommended to be the main indicator.* This is not only because of its being most proximate to the overall project result; the PR1 indicator also provides the best opportunity for a scientifically sound and replicable way of estimating fish stocks based on randomly-identified sampling points within each focal area. This indicator can be monitored using highly standardized methods and gears. Thus, primary (project result) indicators PR2-4 could be considered as “reference indicators” that will be used to cross-check, validate and explain measurements of and trends in PR1. This way, not only can performance analysis be enhanced from different angles; also, richer lessons learned and insights can be drawn for possible replication in other parts of the country. PR1-4 are expected to move in the same general direction; if not, then the

major reason/s for deviation/s or variation/s would have to be identified, explained and used to calibrate not only research methodologies but more importantly, also actual project interventions on the ground. Finally, PR 5 could be regarded as an “enabling indicator” – similar to what was discussed above – because improved benthic conditions provide the environment required for fish stocks to rise over time.

The following table sums up the foregoing discussions regarding the suggested “hierarchy of indicators” resulting from the application of three review criteria: (i) comprehensiveness; (ii) degree of finality; and (iii) primacy. Result and process indicators will be used to monitor the FISH contractor’s performance towards achieving the overall FPR.

Hierarchy	Main Objective	Suggested Specific Indicators
Level 1: Project Results (PR)		
1a. Main Indicator	To best reflect attainment of the overall FISH Project Result (FPR)	PR1 – abundance of selected fisheries resources I focal areas
1b. Reference Indicators	To enrich analysis of PR1 measurements	PR2-4 – catch rate; reef fish density; reef fish species richness
1c. Enabling Indicator	To correlate changes in the host environment, with PR1 measurements	PR5 – benthic condition
Level 2: Intermediate Results (IR) <ul style="list-style-type: none"> ▪ Capacity for fisheries management ▪ National policy framework ▪ Constituency 	To track achievement of desired three major outcomes leading to overall FPR To cover all “pressure and state” concerns in PSR framework	Sustainable harvest; fishing intensity; illegal fishing; & breadth of community participation [MPAs established/improved; barangays adopting health and population programs; supportive policies; & LGUs adopting CRM*]
Level 3: Key Processes <ul style="list-style-type: none"> ▪ Inputs ▪ Activities 	To track progress in delivery of project interventions/inputs leading to intermediate results To cover all “response” concerns in PSR framework	Quality and depth of community participation [Law enforcement units; effort restrictions; collaborative agreements/ partnerships; information dissemination; trainings; & licensing*]

* Already included in draft results framework prepared by FISH contractor

Besides evaluating the FISH contractor’s draft PMP result indicators in terms of comprehensiveness, degree of finality and primacy, a few other observations could be made.

One is that while the primary (PR) indicators are linked to focal areas, the intermediate result indicators go back and forth between focal areas and target areas. It is advisable

for the FISH contractor to uniformly use focal areas as spatial context for project interventions – and performance monitoring, so as to gain strategic focus and avoid spreading available resources too thinly over a wider geographical coverage. The effects of certain project interventions like training and information dissemination will expectedly spill outside the focal areas. In any case, performance measurement could be concentrated inside focal areas. “Intervention-induced externalities” in the non-focal areas, e.g., fishing communities being moved to act on urgent resource degradation issues, could be considered as “bonus performance” for which the FISH contractor should receive credit.

A point related to delimiting the spatial boundaries of performance monitoring is scale of interventions – proportionality between available inputs and expected outputs – to be discussed below. Focal areas could be expanded – or constricted – over time, based on actual implementation experience.

A second observation is that PR1 and PR 2 both refer to “selected fisheries” in focal areas. Specific fisheries resources to be monitored will need to be identified based on the results of the baseline assessment, rather than *a priori*. Priority should be given to species that are most socio-economically significant for “commercial” (i.e., community livelihood) purposes, or for household consumption. Trends in terms of the most common fishing gears used serve as practical starting point for determining the species on which a community depends, including endemic species that are becoming scarce as a result of unsustainable practices.

Third is that the baseline contractor had collected data from six barangays in one sample municipality per focal area. The municipality was selected by the FISH contractor based on operational feasibility. For the next monitoring event, it is recommended that another municipality be selected as area to be monitored but no longer on the basis of operational considerations but rather on the centrality and significance of the fisheries sector vis-à-vis the local economy. Thus, the second municipality in each focal area may or may not be adjacent to the first municipality.

And finally, the indicator for the second intermediate result – “*national fisheries policies supporting sustainable fisheries, e.g., FAO’s MTDP, action agendas for international agreements (number of national policy instruments developed, reviewed or revised with FISH project inputs)*” – would appear to be too weak vis-à-vis desired outcomes. The FISH Project could be more proactive in pursuing reforms; this particular indicator could be strengthened by making explicit the project’s vision – or the process of helping stakeholders to articulate such a vision – regarding the role of national government in providing market-based incentives for compliance and investments in sustainable fisheries, and of local government in catalyzing broad community support towards sustainable management of common property resources. Based among others on information materials already prepared by the FISH contractor, a proactive reform agenda could also include (a) enhancing the equitable distribution of benefits from the use of fishery resources; (b) harmonizing inter-sectoral and intra-sectoral differences; (c) defining a national strategy of marine sanctuaries based on lessons learned in focal areas;

and (d) addressing the present fragmentation of responsibilities for fisheries-related policies.

Methodology

The methodology section of the draft PMP discusses tested methods and protocols to assess indicators of biophysical conditions and institutional capacity and performance. It includes baseline assessment, target area profiling, annual monitoring, and special monitoring events.

In terms of the timing of data collection, analysis and reporting, the Performance Monitoring Plan shows that five project result indicators (fishery-independent CPUE, fishery-dependent CPUE, reef fish abundance, reef fish species, and benthic condition) will be the subject of biennial special monitoring events (Years 2006, 2008 and 2010). On the other hand, the above-recommended additional result indicators such as tons landed by fishers, etc.) can be readily reported on every year. In this light and alternatively, all result indicators could be updated, assessed and reported on annually, in order to (a) help all concerned to more clearly understand the inter-relationship between and among the key indicators; and (b) enable managers to more promptly institute the necessary remedial/corrective measures.

The cost implications of performance monitoring methodologies have been repeatedly raised as a concern by both the FISH and baseline contractors. In this regard, project budget flexibility is necessary to support the continuing use of cost-effective data gathering and analysis techniques. Ideally, more limited data could also be initially collected during the off-season, as the corresponding trends could reveal useful insights. Monitoring costs will expectedly rise as a consequence of using additional indicators; however, costs can be justified not only by the value of having more regular data/information on hand for day-to-day decision-making, but also possibly substantial “project savings” through the increased use of more strategic, catalytic and effective interventions arising from well-informed project policies and decisions.

Engaging an independent, third party contractor for each special monitoring event will maintain professional objectivity, maximum possible consistency in research methodologies, and a high quality of time series analysis.

Performance Indicator Reporting

This section of the draft PMP discusses the baseline assessment, and provides an example of the method for averaging across focal areas and indicators, and indicative performance targets for PR1-3.

[Note: The baseline contractor does not have any comment on the Data Analysis and Management section of the draft PMP, which identifies staff responsible for data analysis.]

The PMP indicates that three project indicators (PR1, PR2 and PR3) will form the primary basis for measuring progress toward achieving the FISH Project result, and that the overall result will be determined as an average of these three indicators. Other primary indicators (PR 4 and PR5), and intermediate result indicators (IR1.1-7; IR2.1; and IR3.1-2) are designed as “supporting indicators”. As discussed above, however, PR1 is recommended to be the main indicator; PR2-4 as reference indicators; and PR5 as enabling indicator.

It is not advisable to average any of the indicators; rather, these should be used separately to compare and analyze any resulting variance in individual values. In the case of PR3, reef fish density inside the MPA cannot be used as an indicator of results, because this value represents (a) a project input, rather than a result, towards increasing fish stocks in the focal area (see above “input-output” discussions related to an indicator’s degree of finality); and (b) fully-controlled conditions (“no-take zone”) that are not representative of realities within the target area. Including reef fish density inside the MPA will lead to unrealistically high estimates of the value of fish stocks. A similar word of caution can be made with respect to PR4 and 5.

Independent baseline assessment results gathered by the baseline contractor show that CPUE is not enough as an indicator of fisheries conditions. There will need to be a variety of indicators to be evaluated separately and in correlation to each other, including catch and size composition, as well as indicators reflecting institutional concerns such as the participation of municipalities, barangays and local communities in sustainability-oriented capability-building interventions.

Others Recommendations

Proportionality of Interventions – Project managers should ensure that “adequate and timely” resources would be available to achieve the project objective of increasing fish stocks by 10% at the end of seven years. Detectable changes in fish stocks should be directly link-able to specific project inputs. While this would appear “to go without saying”, one too many projects still suffer from over-ambitious targets, both in terms of magnitude and timing of results. Quantitative annual targets in terms of both the “scale of results” and the “scale of interventions” should be clearly established – and matched – at the very start. Defining Year 2004 baseline conditions in the “focal areas” is most useful. Project inputs (technical assistance, training, etc.) should be large enough to improve CPUE, reduce commercial landing from municipal waters, increase biomass and variety, and cause a detectable change in other key indicators within the focal areas. But how large exactly is “large enough”? This question can be answered using predictive input-output simulation models such as the FISH BE.

Adaptability – The need to clearly establish and match quantitative targets in terms of interventions and results early in the life of the project does not mean however that said targets will be fixed. In line with the “adaptive management” approach recommended for

the FISH Project⁸, the annual targets would be reviewed and assessed based on the year-end reporting on key result areas. Special monitoring events will also provide project managers with the opportunity to review the completeness, appropriateness and adequacy of the performance indicators, and to update/refine the PMP – and PFPP – as appropriate.

Consistency in Data Collection Methodology – For monitoring results to be spatially and temporally comparable, project managers should ensure that research methodologies are not only consistently described but also consistently applied. The documentation of the methodologies contained in the Baseline Assessment Plan is a good beginning (e.g., use of GPS and/or cement blocks to establish/confirm randomly-selected data collection points that are to be consistently covered in the future); the Plan could be reviewed annually for possible refinements. Consistency in the application of research methodologies is where engaging the same independent contractor becomes a key factor. Another possible way to enrich the research methodology is to identify selected control sites, i.e., at least one barangay outside each of the focal areas, to collect more limited data to serve as basis for a “with versus without project” analysis. Data from the control sites will not necessarily be used to compare performance, but rather to help explain and understand performance. Again, this will entail additional monitoring costs, which should be justifiable on the basis of data/information generated and used in formulating key project policies and decisions. Also, care should be taken so as not to unduly raise community expectations with respect to possible project interventions in control sites.

Performance Fee Payment Plan (PFPP)

The PFPP section of the FISH contractor’s original technical proposal submitted to USAID, which the former provided to the baseline contractor, presents a draft results framework, and assuming achievement of targets, payment of equal amounts of performance fees on Years 6 and 7 of project implementation. Other than two tables on the results framework and on the schedule of results delivery and performance fees, no further discussion is made about fee payments.

The FISH Project performance contract is a much-welcome innovation to provide an incentive for a contractor to endeavor to exceed targeted levels of performance. It is noted that the FISH contractor is being paid for its effort to achieve the overall result of increasing fish stocks by 10% by 2010. If it achieves this overall result, then there is a corresponding “bonus” (or “reward”) in the form of a performance fee. The large magnitude of the effort to be required in achieving a 10% increase in marine fish stocks at the end of seven years must be viewed in light of a “negative velocity of change”, i.e., the historically negative growth rates in many areas in the country including parts of Bohol. Nonetheless, the benchmark for the 10% increase will clearly be the 2004 baseline assessment results.

The above discussions regarding the draft PMP tie in to the PFPP, particularly in terms of unequivocally determining when the 10% increase in fish stocks would have been

⁸ DAI/MERF, “Review of Baseline Assessment in Fisheries”, 14 November 2003, page 8.

achieved. In this regard, the baseline assessment results, including the high variability of data such as on catch rates and species, consistently show the need to use (a) a combination of data collection methodologies (survey, FGDs, Key Informant Interviews, transect walks, etc.), the results of which should be triangulated; and (b) a mix of biophysical and institutional indicators that can be cross-referenced with each other using multivariate analysis.

The fundamental nature of the performance fee however may also need to be clarified: is it meant to be a bonus or reward to the FISH contractor, rather than tied in to specific activities that the FISH contractor must perform during Years 6 and 7? Some of the discussions between the FISH and baseline contractors suggest that this is an area for further clarification, in order to enhance the chances of success of this innovative incentive system. It is recommended that (a) the “bonus nature” of the performance fee be affirmed, and (b) non-payment of the performance fee should not be used as sole basis for not extending the FISH contractor’s engagement through Years 6 and 7.

The foregoing discussions have suggested that the performance fee should be paid to the FISH contractor depending on PR1 (abundance of selected fisheries resources in focal areas), with analysis of results enriched by cross-referencing PR1 values against those for PR2-5. But what if a 10% increase in PR1 is achieved for some of the focal areas, but not for the other/s; should the performance fee be paid? Consistent with an earlier suggestion, PR1 values should not be averaged across sites. Instead, it is recommended that the performance fee be divided among the four focal areas (an equal division seems to be most practical), and that payments be made accordingly. This is to account for the unique ecosystem in each area, and the already high target of 10% increase in stocks, considering (a) negative growth trends in fish stocks in many places; and (b) the project’s resource-leveraging capability particularly at the LGU level now being severely constrained by the national fiscal crisis.

Summary and Recommendations

The objectives of the Independent Baseline Assessment were to provide an independent validation of the baseline assessment of the target sites. In addition a review is made of the PMP and the PFPP including recommendations for issues and concerns, for possible adjustments and replication. An ecosystem based fisheries management approach was utilized to harmonize biodiversity conservation objectives with sustainable utilization through fisheries management and equitable access arrangements.

A habitat based ecosystem connectivity design was the basis for the development of complementary indicators that were evaluated. The significance of the performance indicators and the relation with possible management interventions was evaluated.

Site characterization of the initial focal areas situated in the target sites provided the basis to gauge the state of the ecosystems at the target sites and the pressures of the ecosystems, its resources and resource users. It showed that Talibon, Bohol is the most heavily fished areas with very low catches per fisher-hour followed by Cortes, Surigao. Bongao and Culion are the least overfished areas concordant with the fishery independent estimates (e.g. fish visual census) and the size class distribution of some of the species caught in the area.

This baseline assessment information provided the basis for the consensus building process, its refinement and further evaluation of the project result (PR) indicators. The main PR indicator that will be utilized for focal site and target site evaluation, and basis for payment of the performance fee, is recommended to be PR 1 = catch per unit effort based from fishery independent estimates in the soft bottom areas. Three other indicators will be reference indicators such as PR2 = catch per unit effort based on fish landings from the various fishing gears in the area; PR 3 = fish abundance based on fish visual census of representative sites of at least 10% of the coral reef areas; and PR 4 = species composition changes including species richness. PR 5 = living coral cover estimates of the coral reef benthos will be an enabling indicator. Other intermediate results and process indicators are closely linked to the overall outcome of the FISH project's target of an increase in 10% of the fish stocks by 2008 from baseline 2004 levels.

The processes and lessons learned from the baseline assessment and the engagement of the independent baseline assessment contract should be emulated and replicated in other resource management projects. The following are the highlights, insights and recommendations derived from the baseline assessment process:

1. Independent Baseline Assessment review of good practices is crucial in the entry phase engagement with the contractor.
2. Consultation and feedback with the contractor and other stakeholders on site should be consistently pursued.
3. Parallel independent baseline studies should be complemented with comparative techniques and analyses with the contractor.
4. Development, review and refinement of indicators should be undertaken in an open and learning environment (such as the integration workshops) to achieve reconcilable and complementary contribution for the benefit of the project.
5. Enhancement through further baseline profiling and monitoring, should be consistent with clearly identified performance objectives vis-à-vis its interventions (e.g. fishing effort regulation and enhancement), and the expected outcomes (e.g. 10% increase in sustainable harvests).
6. Insights and suggestions have all been highlighted in most of the sections of this report (especially in Sec. 2 to Sec.5) and recapitulated here. The implications of the use of these indicators to the subsequent performance monitoring, and suggested evaluation process for the award of the performance fee is succinctly discussed in Sec. 5.
7. It is proposed that each site will equally and distinctly be considered for the performance fee payment. The evaluation of the overall performance and the consideration for extension will not only be based on the 10% increase of the fish stocks. It should consider the overall project performance and impact (at the very least in staving off the fisheries decline in all the areas).
8. Use of a single main indicator (recommended to be PR 1) will simplify monitoring and assessment towards achievement of the overall project objective. Adding various other indicators as main indicators – to be averaged within and across focal areas – is not advisable considering data collection and analytical

constraints. Other indicators (categorized as reference, enabling, intermediate results and process) are recommended to be used to support the main indicator.

The baseline assessment process as integrated with an ecosystem based management approach are but the first steps in meeting the challenge of producing results of enhancing fisheries sustainability to achieve the desired outcome of the 10% increase in fisheries stocks.